Digital Storage Oscilloscope

GDS-1000-U, GDS-1000A-U, GDS-2000A, GDS-3000 Series

Freewave Installation & User Guide

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

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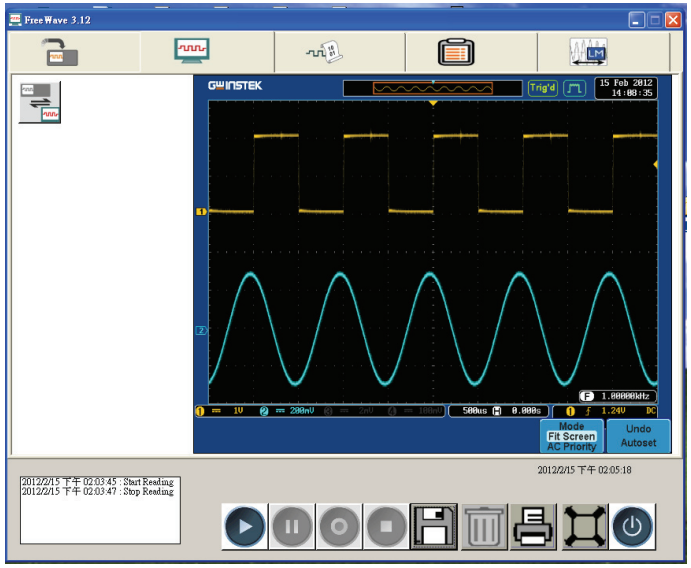
GETTING STARTED

Freewave supports the GDS-1000-U, GDS-1000A-U, GDS-2000A and GDS-3000 series oscilloscopes and is freely available to all customers.

Freewave can transfer full screen images, video, or waveform data from an oscilloscope to a PC via a USB connection. The software display is updated in real-time from the host oscilloscope. Images and movie clips can also be saved onto the PC. Images can be printed directly to a printer.

For data analysis, Freewave is able to capture raw waveform data from the oscilloscope and display it on the PC screen. Waveforms can be saved in CSV format to be reused in other applications. Freewave can also record long memory or standard memory length waveforms with the GDS-1000A-U and GDS-2000A series.



Overview

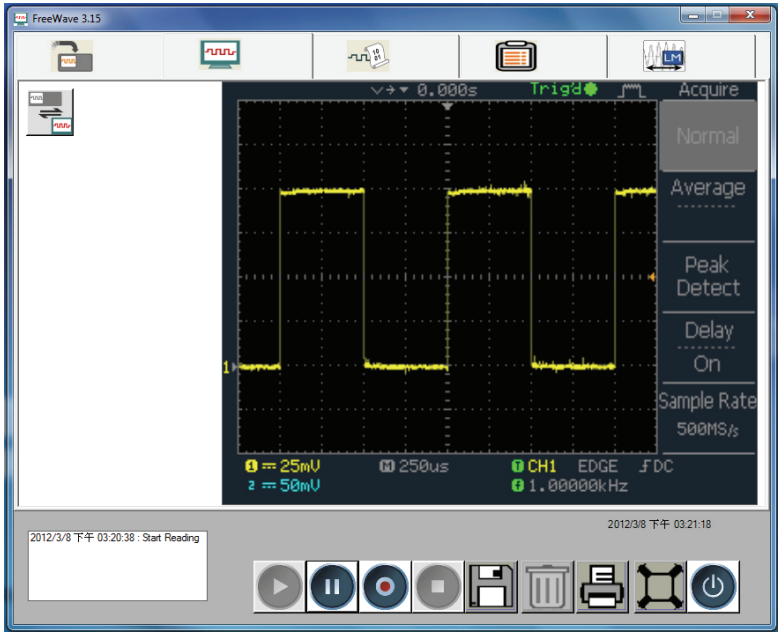
Applicable oscilloscope	• GDS-1000-U • GDS-1000A-U • GDS-2000A • GDS-3000
Applicable OS	• Windows XP (32 bit) • Windows Vista (32 bit) • Windows 7 (32 bit, 64 bit) • Windows 8 (32 bit, 64 bit)
Main features	• Updates the oscilloscope display in real-time, allowing remote observation. • Virtual Panel operation • Records oscilloscope images. • Records video clips to a PC (GDS-1000-U and GDS-1000A-U only) • Captures digital waveform data in CSV format. CSV is viewable and editable in most spreadsheet applications. (standard and long record lengths) • Automatically loads remote commands, supports command lists, running commands and saving results to a PC. • Supports fast USB 2.0 connections and captures the oscilloscope display in almost real-time. • Automatically recognizes the oscilloscope hardware and configures the channel number and remote control commands accordingly. • Prints out snapshots of the oscilloscope display. Inverting the background color is also available.

Types of Operations

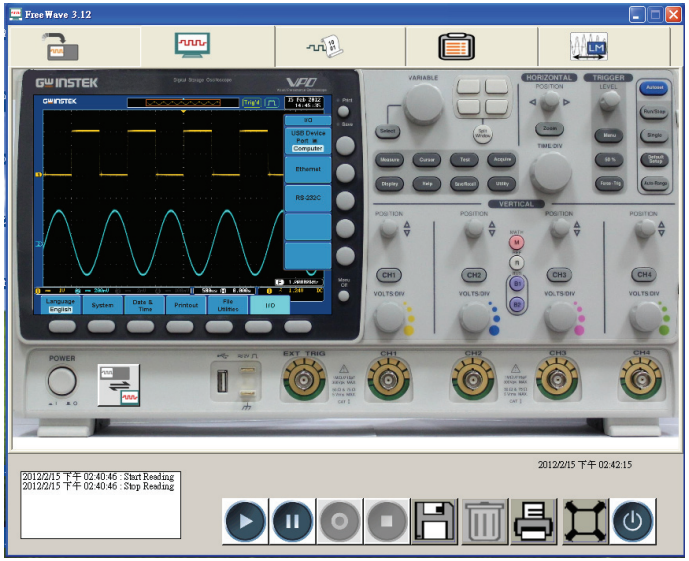
Four types of operations are available in Freewave: Standard memory length display monitoring, data capturing, and remote controlling, long memory length data capturing.

Monitoring the Oscilloscope Display

The oscilloscope display contents appear in the Freewave screen in real-time. You may store a snapshot image or video clip into the PC, and invert the background color for better viewing. Snapshot images can also be printed out. The oscilloscope monitor can be switched between the Freewave screen and a simulated oscilloscope display.

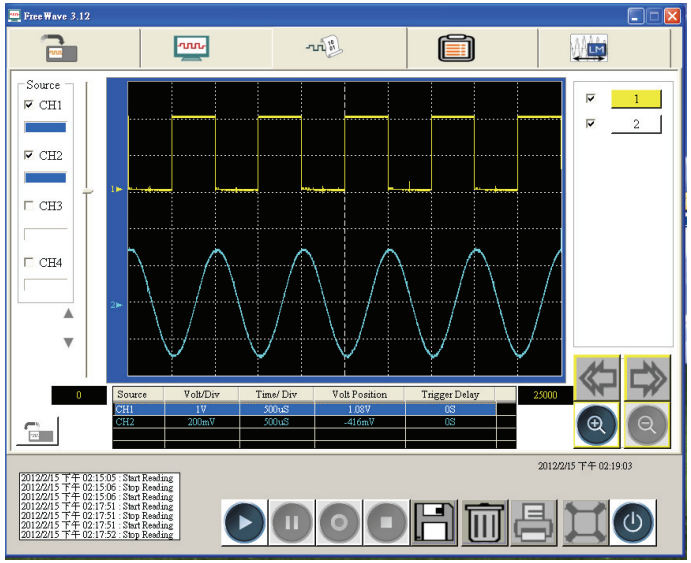


When using the simulated display, all oscilloscope functions and controls are available on a virtual oscilloscope panel.

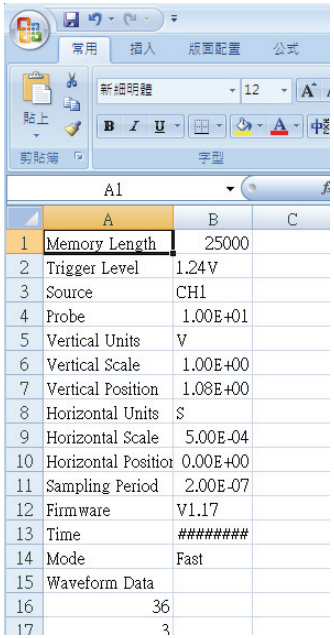


Standard Memory Length Data Capture

Standard memory length data can be directly transferred to the Freewave screen. Up to 10 waveforms can be captured at any one time for analysis. All waveforms can be zoomed and panned as well as positioned vertically.



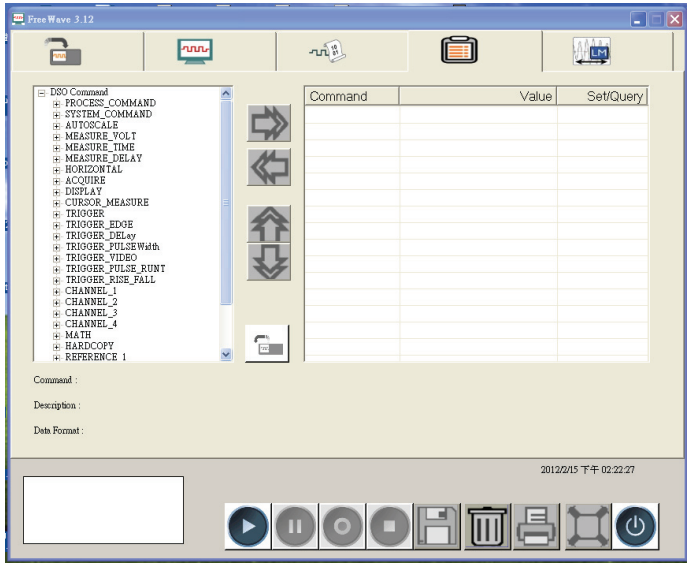
Waveform data as well as the oscilloscope identification can be stored as a Comma Separated Values (*.csv) file which can be opened and edited by a spreadsheet application such as Microsoft Excel.



	A	B	C
1	Memory Length	25000	
2	Trigger Level	1.24V	
3	Source	CH1	
4	Probe	1.00E+01	
5	Vertical Units	V	
6	Vertical Scale	1.00E+00	
7	Vertical Position	1.08E+00	
8	Horizontal Units	S	
9	Horizontal Scale	5.00E-04	
10	Horizontal Positior	0.00E+00	
11	Sampling Period	2.00E-07	
12	Firmware	V1.17	
13	Time	########	
14	Mode	Fast	
15	Waveform Data		
16	36		
17	3		

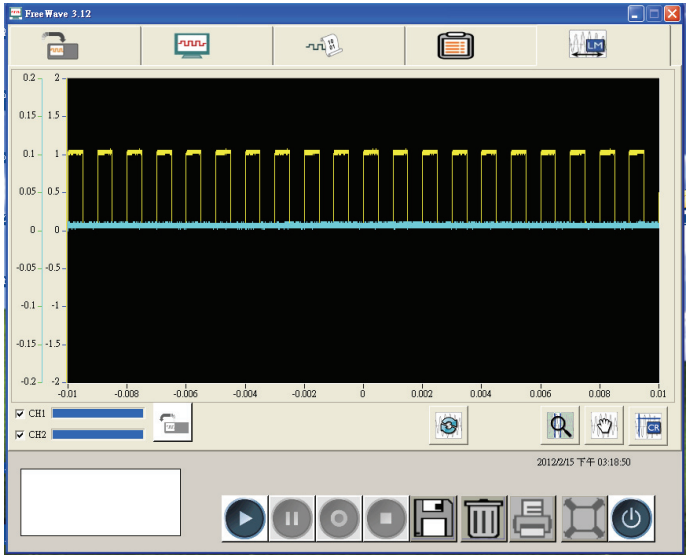
Remote Controlling the Oscilloscope

Freewave automatically categorizes and lists the remote control commands. To run the commands, users only have to pick and place them on the list; no manual typing is required. The result can be stored in CSV format.



Long Memory Length Data Capture

Freewave can take advantage of the long memory length of the GDS-1000A-U and GDS-2000A series oscilloscopes. Waveform data can be arbitrarily zoomed and panned with ease. Cursors can be placed on the screen to accurately view measurements. Like the standard memory length data capture, long memory data can be saved as a *.csv file to be recalled at any time.



INSTALLING FREEWAVE

The installation process includes preparing the necessary equipment, installing the software package to the PC, and confirming the connectivity.

Required Equipment

The following list shows the necessary hardware and software for installing and running Freewave.

Item	Requirements
Oscilloscope	• GDS-1000-U • GDS-1000A-U • GDS-2000A • GDS-3000
Freewave package	• Version 3.21 (for Windows XP or Windows 7) • Version 3.22 (for Windows 7 or Windows 8)
Required software for Freeewave V3.21	• Windows XP or Windows 7 (32 or 64 bits) • Microsoft. Net Framework full version 4.0 or later. • Microsoft Visual C++ 2010 Redistributable Package(x86)
Required software for Freeewave V3.22	• Windows 7 or 8 (32 or 64 bits) • Microsoft. Net Framework full version 4.5 or later (for Windows 7 only) • Microsoft Visual C++ 2010 Redistributable Package(x86)

Note	The NET 4.5 is built-in in the Win8, so user doesn't need to install again.
USB driver	• Version 1.03 or above
USB cable	• USB 2.0, type A (PC) – type B (oscilloscope)

Install Required Software

- Microsoft .Net (full version 4.0 or later) and Microsoft Visual C++ 2010 Redistributable Package (x86) are required to use some of the Freewave functions for PCs with a 32 or 64 bit OS
- Microsoft .Net and Microsoft Visual C++ 2010 Redistributable Package (x86) can both be downloaded for free from the Microsoft website.

1. Click on the *Control panel*>*Add or remove program* option. The list of installed programs will appear. Check if Microsoft .NET is installed.

2. If Microsoft .NET (full version 4.0 or later) is not appropriately installed, download and install the latest versions from the Microsoft website.
http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=17718

3. If Microsoft Visual C++ 2010 Redistributable Package (x86) is not appropriately installed, download it from the Microsoft website.
http://www.microsoft.com/en-us/download/details.aspx?id=5555

Installation Steps

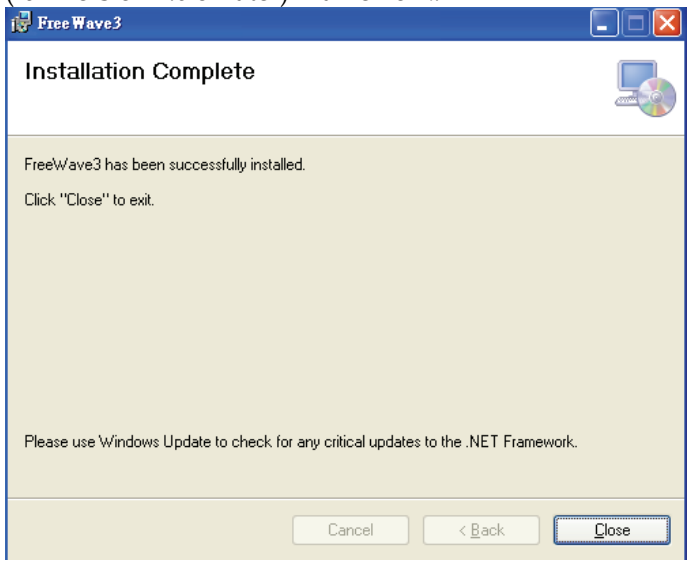
Follow these steps to properly install Freewave:

- Download and install the software package.
- Connect the oscilloscope to the PC.
- Verify the connection and operation.

Installing the Software Package

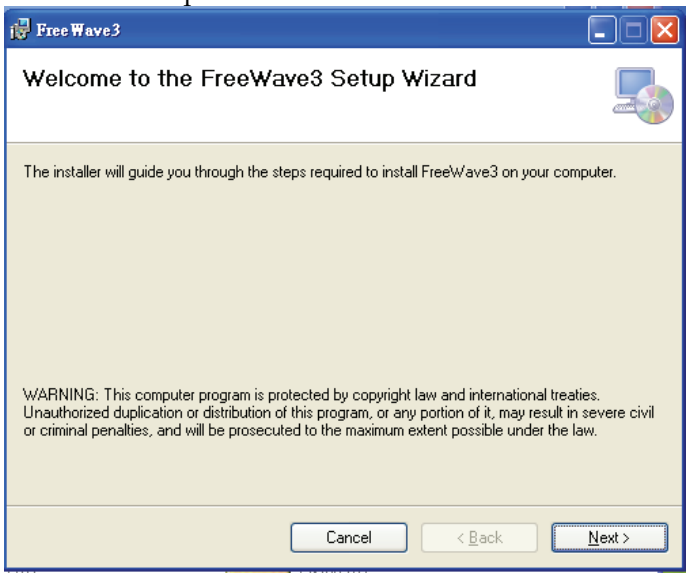
1. Unzip the software package into an installation directory.

2. Activate setup.exe. if a dialog box appears for the Microsoft .Net (full version 4.0 or later) framework.



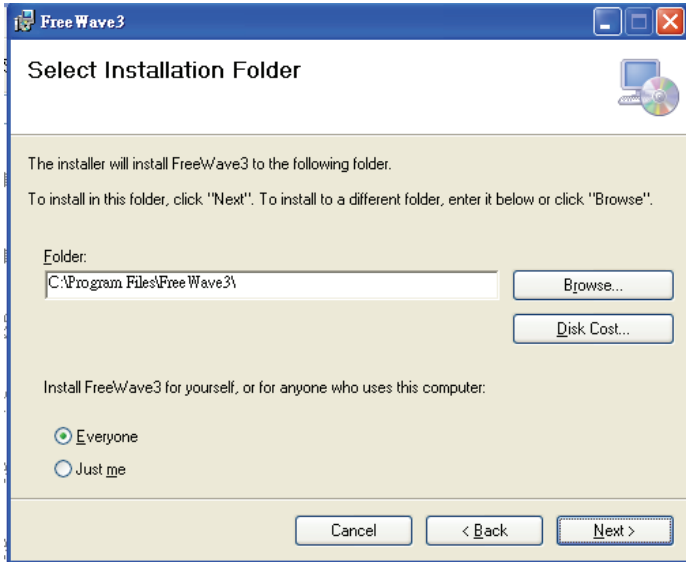
3. When a dialog box appears for installing FreeWave, click the

Next button to proceed.

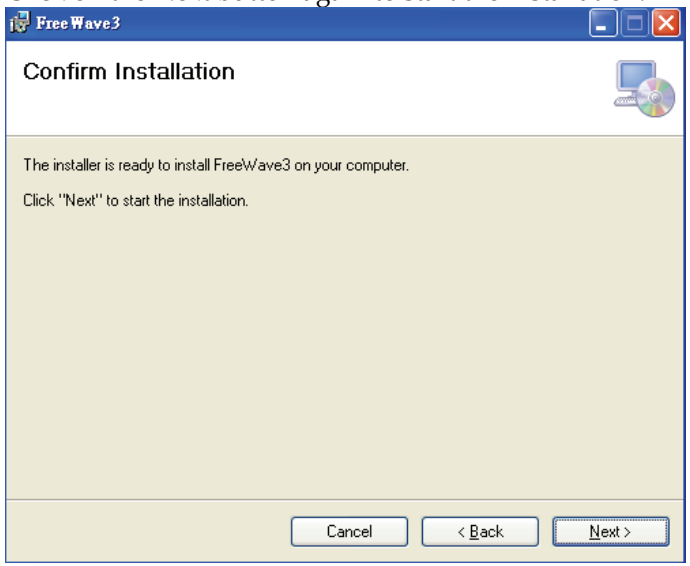


4. Select the directory in which Freewave is to be installed. Click Next.

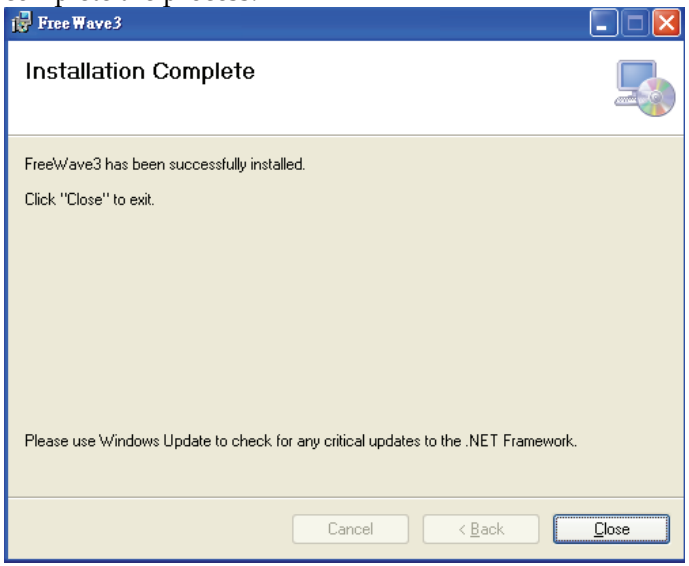
- To change the directory, click on the Browse button and select another directory from the directory map.
- To calculate the occupied space, click on the Disk Cost button. A separate dialog box will appear, showing the disk space required for Freewave and the entire space in the drive.
- To control the software accessibility, check “Everyone” or “Just me”.



5. Click on the Next button again to start the installation.



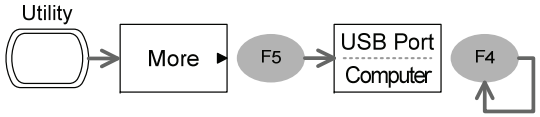
6. When the installation is completed, click on the Close button to complete the process.



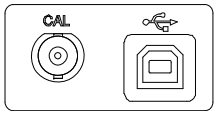
Connecting the Oscilloscope and Verifying Connectivity

1. Power the oscilloscope up.

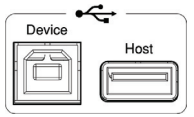
2. Select the USB interface by pressing the Utility key, followed by F5 (More). Then, press F4 (USB Port) repeatedly until Computer is selected.(GDS-1000A-U and GDS-1000-U only)



3. Connect the USB cable between the oscilloscope and PC.

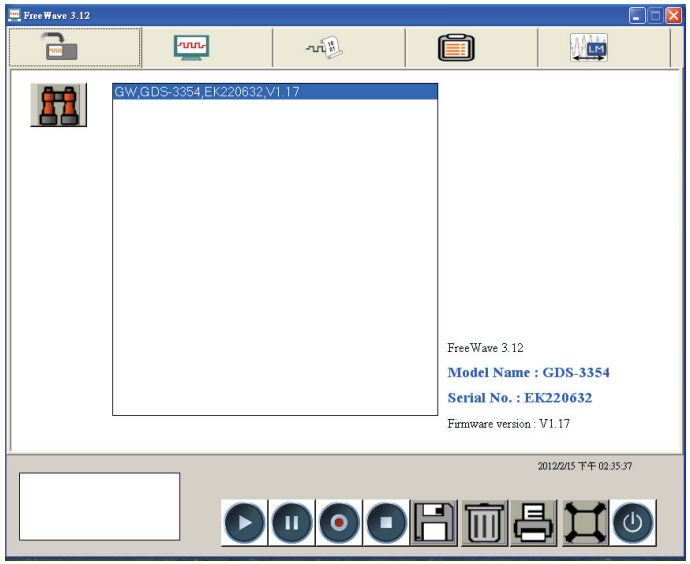


GDS-1000-U, GDS-1000A-U USB slave port



GDS-2000A, GDS-3000 series USB slave port

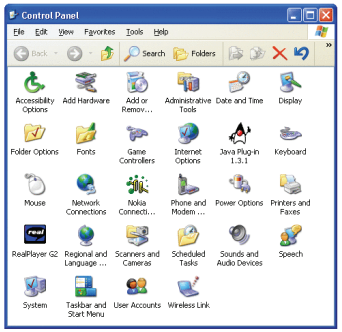
4. Activate Freewave. If the oscilloscope ID appears on the screen, Freewave is ready for operation.



5. If the oscilloscope ID does not appear in the initial display, click on the Scan (binoculars) icon to manually search for the oscilloscope. If this still fails, follow the instructions in the next section, "Manually Installing the USB Driver".

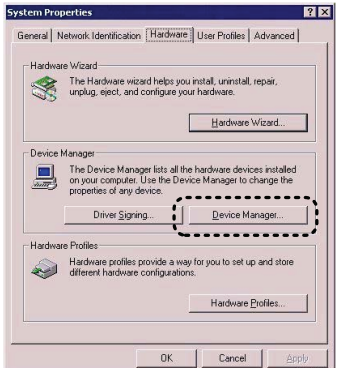
Manually Installing the USB Driver

1. Open the Control Panel in the PC and activate the System icon.



2. Select Device manager.

In Windows XP, select the Hardware tab and activate the Device Manager.

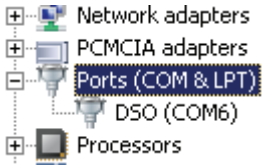


In Vista, select Device Manager from the side menu.

A

3. Locate the oscilloscope either in the "Port" node (correct) or in the "Other devices" corner (incorrect).

Port (correct)

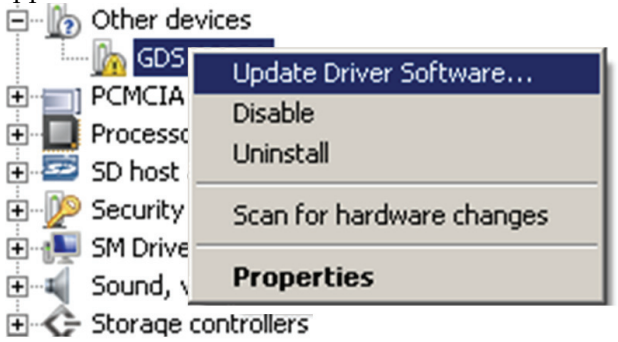


Other devices (incorrect)

- If the oscilloscope is correctly recognized (Port node), repair the Freewave installation (page26).
- If the oscilloscope is incorrectly recognized (Other devices node), follow the next step.

Note The COM port for the DSO should be set between COM1 to COM20. If the COM port is greater than 20, it can't be detected by DSO.

4. Right-click on the oscilloscope name and select "Update Driver" from the context menu. The driver installation dialog box should appear.

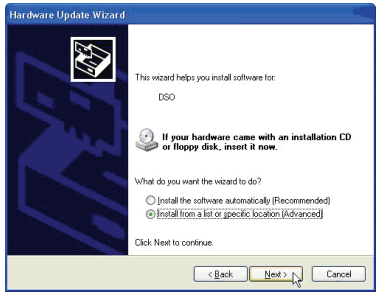


5. Install the DSO driver from the Freewave install directory.

XP

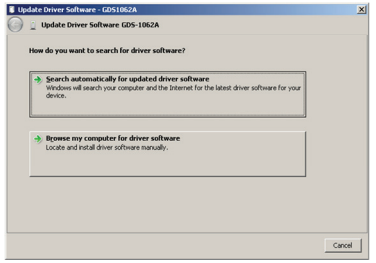
6. In the dialog box, select "No, not this time" (not connecting to Windows Update) and click on the Next button.

7. Next, select "Install from a list or specific location" and click on the Next button.

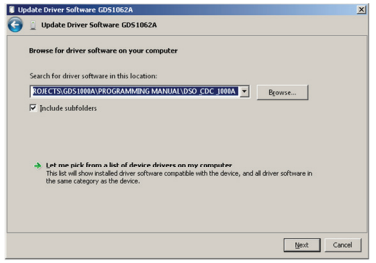


Vista

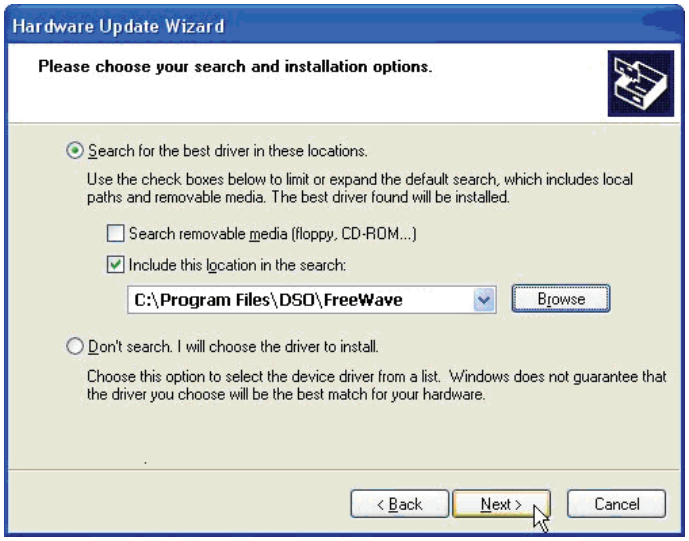
In the "Update Driver software – GDSXXXX", select the "Browse" dialog.



Click Browse and select the Freewave installation directory. Press Next.



8. Select the directory where Freewave is installed and click on the Next button. The USB driver "dso_vpo.inf" will be installed. Click Next.



9. Check the Device Manager again. The oscilloscope should now be recognized in the "Ports" node as DSO.

Repairing/Uninstalling Freewave

After installing Freewave, repairing or uninstalling Freewave is possible using the same setup.exe file used to install the program.

Repair	Repairs corrupted functions by reinstalling Freewave. Select this function if Freewave starts malfunctioning.
Remove	Uninstalls Freewave from the PC.

1. Acitvate the setup.exe. A dialog box will appear.

2. Select Repair or Remove and click on the Finish button. Repair or removal starts and finishes automatically.

3. When it is completed, click on the Close button to complete the procedure.

MONITORING THE OSCILLOSCOPE

The oscilloscope display contents appear in the Freewave screen, allowing observing and recording the waveforms in analog form; for capturing digital waveform points, refer to page27 "Monitoring the Oscilloscope". Here are the available operations.

- Viewing the oscilloscope's display contents
- Taking a snapshot image of the display contents
- Recording a movie clip of the display contents
- Printing out the display contents

The Virtual panel is able to remotely control a connected DSO and display the DSO contents back onto the Virtual Panel display. All functions and operations that can normally be performed on the DSO panel can be performed on the Virtual Panel.

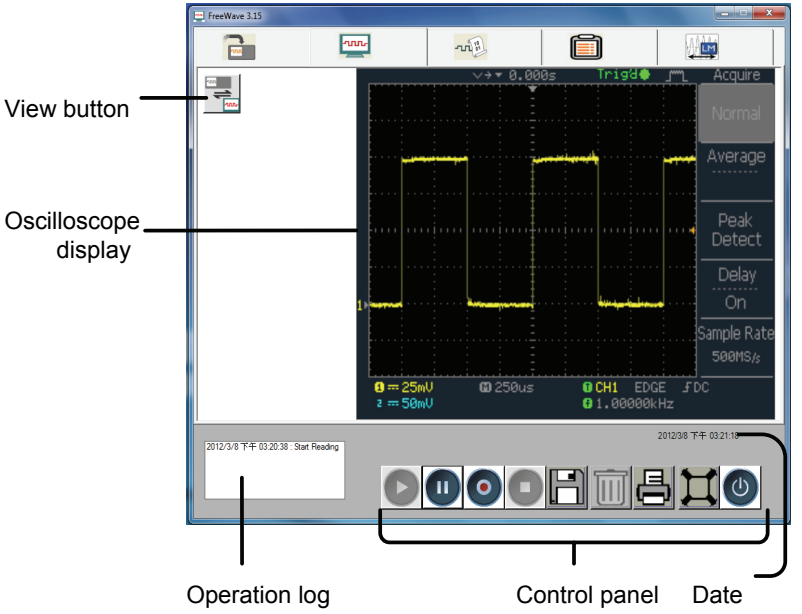
Viewing the Oscilloscope Display Contents

1. Connect the oscilloscope to the PC and activate Freewave. For details, see page20.
2. Select the Image tab (second from the left).

3. Click on the Play button in the control panel. The oscilloscope's display contents will appear on-screen.

Note

The GDS-1000-U/1000A-U will continually send a screen shot to the PC, while the GDS-2000A or GDS-3000 will only send an initial screen shot once when the PLAY button is clicked.



Pausing the display

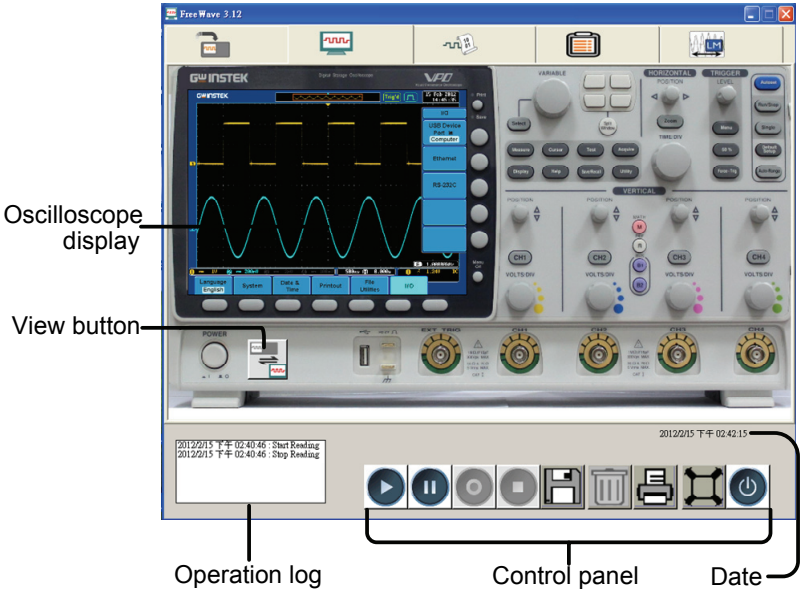
To stop updating the display, click on the Pause button in the control panel.

Note	The pause button only applies to the GDS-1000-U/1000A-U
Viewing in full-screen mode	To view the display in full-screen mode, click on the Full-screen button in the control panel. Note: to go back to the original screen size, press the Space key, or double click anywhere on the screen.
Closing Freewave	To close Freewave, do one of the following: • Click on the Close button in the control panel • Press the Alt + F4 keys • Click on the Close icon at the top right corner of the screen.

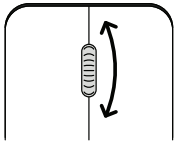
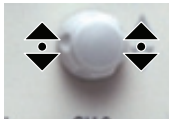
Viewing the Oscilloscope Virtual Panel

1. Make sure that the oscilloscope's display contents appear in the Freewave screen. See "Viewing the Oscilloscope Display Contents", page 28.

2. Click the View button to toggle the display.



Operating Panel keys	Left clicking on any button in the virtual panel will perform the same operation on the DSO remotely.
Operating Variable knobs	To use any variable knob, place the mouse cursor over a variable knob until the cursor changes to a scroll arrow.

	Use the mouse scroll wheel to scroll the virtual variable knob.	
Note	To operate a variable knob without a scroll wheel, click on the left or right of the variable knob to scroll anticlockwise or clockwise, respectively.	
Return to the Freewave screen	To return to the Freewave screen view, press the View button again.	

Taking a Snapshot of Display Contents

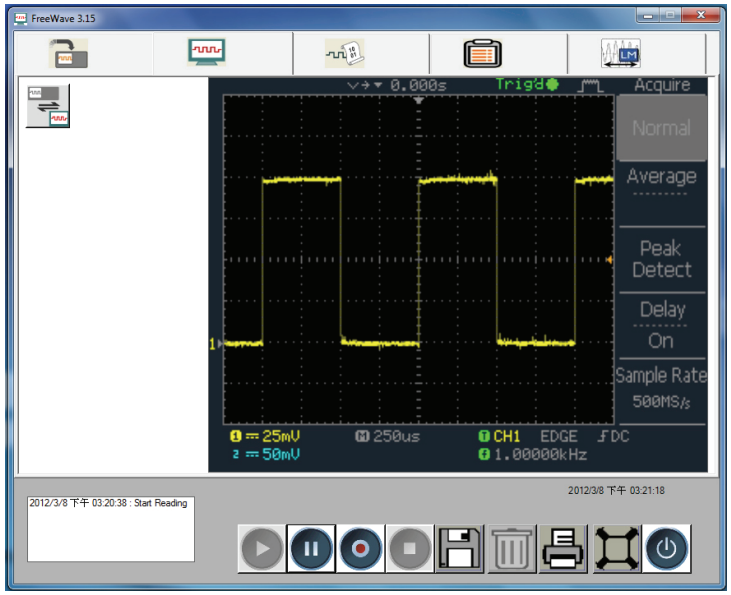
1. Make sure that the oscilloscope's display contents appear in the Freewave screen (both Play and Pause mode works fine).
2. Click on the Save button. A file save dialog box will appear.
3. Select the file type and location and save the snapshot image.

File type	GIF (*.gif)	JPEG (*.jpg)
	Bitmap (*.bmp)	TIFF (*.tif)
	PNG (*.png)	

Taking a Video Clip of the Display Contents (GDS-1000-U and GDS-1000A-U only)

1. Make sure the oscilloscope's display contents appear in the Freewave screen, updated in real-time (Play mode).

2. Select the recording area by selecting either "Freewave Screen" or "Oscilloscope Display" in the Video Recording Area panel.



3. Click on the Record button. Freewave automatically starts recording the display contents.

4. To stop the recording, click on the Stop button which will open a file save dialog box. Enter the file name, select the directory, and save the video in the *.wmv format.

Printing Out Display Contents

1. Make sure the oscilloscope's display contents appear in the Freewave screen (both Play and Pause mode works fine).

2. Click on the Print button. A standard Windows printout dialog box will appear.

3. Configure the printer and printout the oscilloscope display contents.

SHORT MEMORY DATA

CAPTURE

The Data Capture function in Freewave directly transfers standard memory length waveform data (4k points) from the oscilloscope to the PC. Captured digital waveform data is stored in CSV format. CSV is compatible with most spreadsheet applications. The Data Capture function is used to:

- View oscilloscope waveforms
- Save waveform data

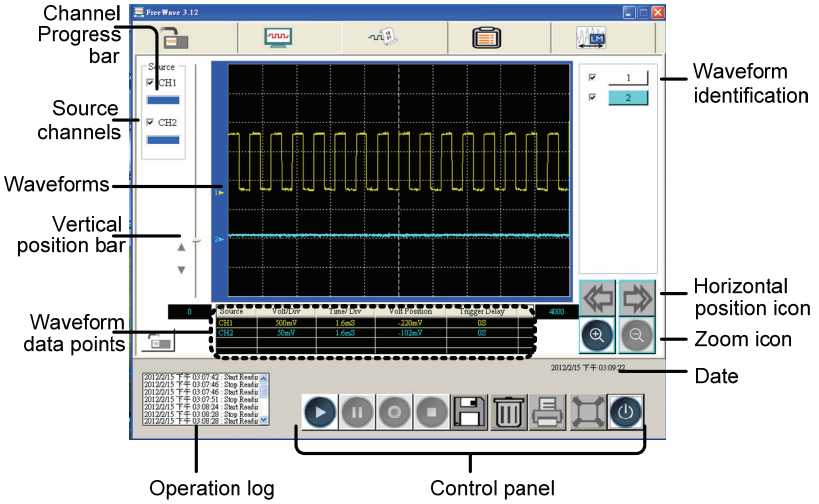
Viewing Oscilloscope Waveforms

1. Activate Freewave and connect the oscilloscope to the PC. For details, see page20.

2. Select the Data tab (second from the right).

3. Select the channel(s) from the Source panel on the left side of the Freewave screen.

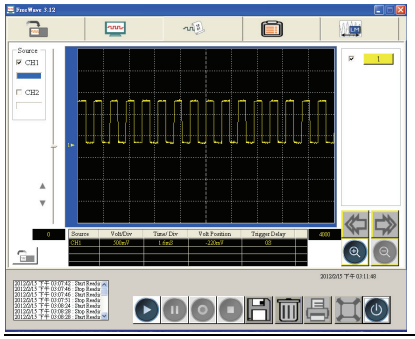
4. Click on the Play button in the control panel. Freewave captures the waveform data for a single period and shows them in the screen.



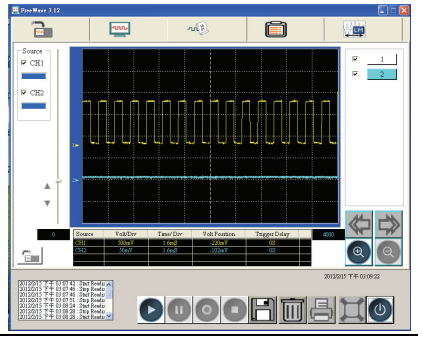
Adding a new waveform	Select a new channel (if necessary) and click on the Play button again. Each time the Play button is pressed a new waveform is captured and placed in the Waveform Identification list.

Note:	A maximum of only 10 waveforms can be added to the waveform identification list.

One waveform

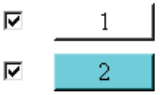


Two waveforms

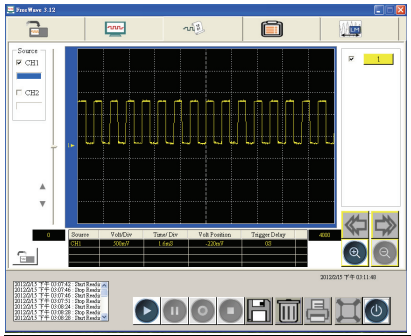


Hiding a waveform from the display

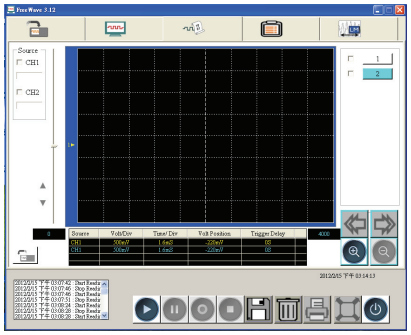
To hide a waveform, uncheck the check box next to the waveform in the Waveform Identification list. The waveform data itself will not be deleted.



1st channel on



1st channel off



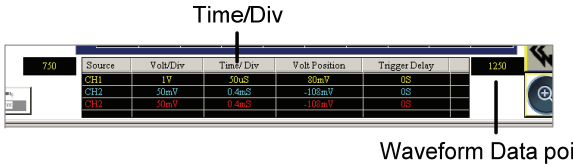
Zooming in or out

First, activate a waveform by clicking on a waveform button number.

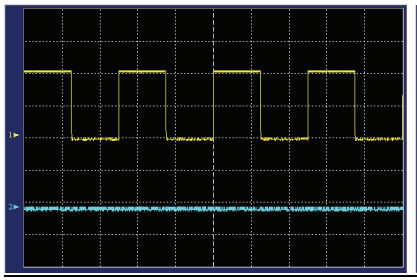
When a channel is activated, the waveform button will become colored.

To zoom in, click on the Zoom In (+) icon. To zoom out, click on the Zoom Out (−) icon.

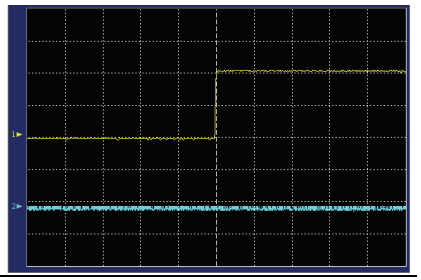
The on-screen waveform data points will be shown under the oscilloscope display. Likewise the Time/Division rate will also be updated.



Default (4,000 memory points)



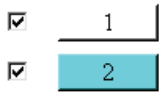
Zoomed (1,250 memory points)



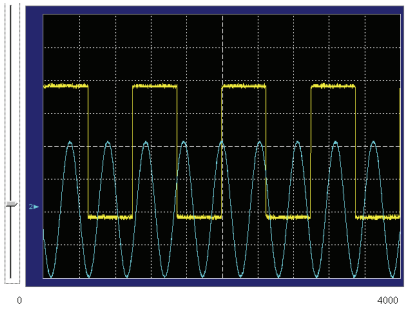
Vertically moving a waveform

Click on the waveform ID and then grab the short bar on the left side of the display. Move the bar up or down to change the waveform position vertically.

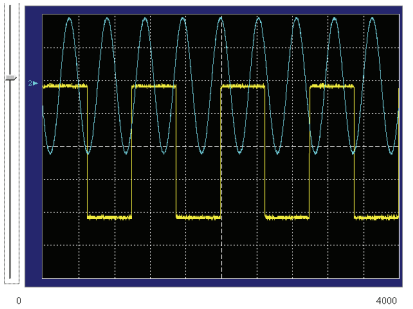
(No.2 selected)



No.2 waveform moving down

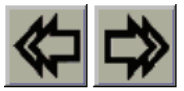


No.2 waveform moving up

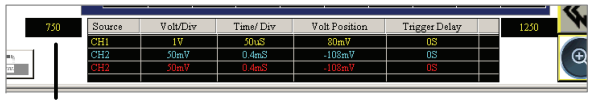


Horizontally moving a waveform

(This operation is available only when the waveform is zoomed in.) Click on the Left or Right icon to move the waveform horizontally.



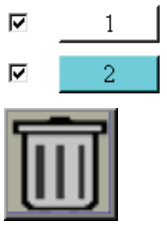
The waveform position will be shown under the vertical position bar.



Vertical postition

Deleting the waveform data

To delete a waveform data, click on the waveform ID and then click on the Delete icon.



Saving Waveform Data

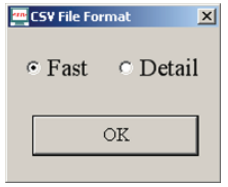
1. Make sure that the waveform appears in the Freewave screen.
2. Click on the Save button. A file save dialog box will appear.

3. Select the file type and location and save the data. CSV data files store the waveform data points as well as the oscilloscope identification. Image data files store a snapshot of the waveform.

Data file format	• CSV (*.csv)	
Data file contents	• Manufacturer	• Model name
	• Serial number	• Firmware
	• Saved Date	• Waveform Data
Image file format	• GIF (*.gif)	• JPEG (*.jpg)
	• Bitmap (*.bmp)	• TIFF (*.tif)
	• PNG (*.png)	•

When saving CSV data files, you will get the option to save as "Fast" or "Detail" waveforms. Detail waveforms save the amplitude and the time of each point relative to the trigger point. Fast waveforms only store the amplitude data.

4. Choose Fast or Detailed and click OK.



Recalling Waveform Data

1. Click on the Recall button.

2. Select a file to recall from the file panel. Make sure that the file is a short memory length file.

Data file format
- CSV (*.csv)

Data file contents
- Manufacturer
- Serial number
- Saved Date
- Model name
- Firmware
- Waveform Data

Both Fast and Detail file formats can be recalled.

USING THE COMMANDS

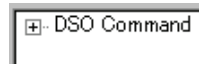
The command function in Freewave allows the oscilloscope to be controlled remotely without using a separate terminal application. Commands are categorized and labeled along with their descriptions. Data format and command order can be semi-automatically configured. Command results are shown in the screen and can be saved to a CSV file. Here are the available operations:

- Preparing a command list
- Configuring and running commands
- Saving a command list and its result

Preparing a Command List

1. Activate Freewave and connect the oscilloscope to the PC. For details, see page20.

2. Select the leftmost Command tab.

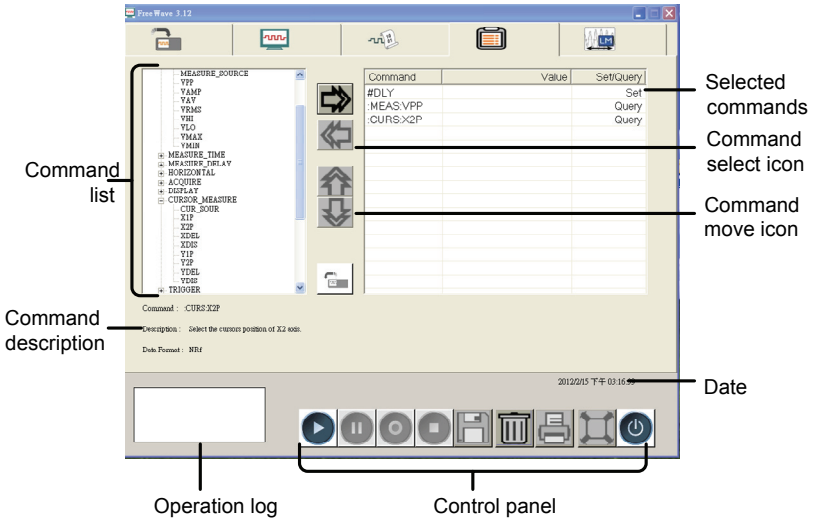
3. Click on the "DSO Command" node on the left side. A detailed command list appears. 

Command list

The Command description area contains three types of information:

- Command: shows the command name in short mode
- Description: describes what the command does
- Data: shows the command's data format

For more details, see the GDS-1000-U, GDS-1000A-U, GDS-2000A and GDS-3000 Programming Manual.



4. Click on the command category to show each command (example: voltage measurement commands).

5. Click on a command and then click on the right arrow to copy the command into the command list (example: MEAS:SOUR command).

6. Repeat this until all commands are copied into the command list.

Deleting a command

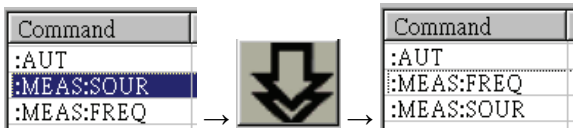
Click on a command in the command list and then click on the left arrow. The command will be deleted from the list.

Changing the command order

Click on a command in the command list and then click on the up or down arrow. The command changes its position in the list.

Moving a command (MEAS:SOUR) up

Moving a command (MEAS:SOUR) down

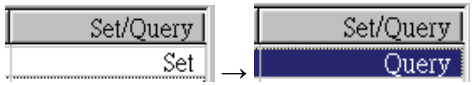


Configuring and Running the Commands

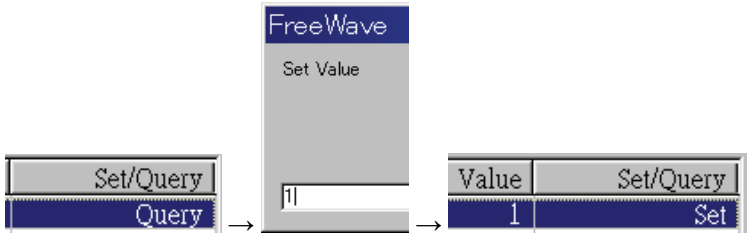
1. Prepare the command list according to the previous section.

2. Configure the parameters of the commands.

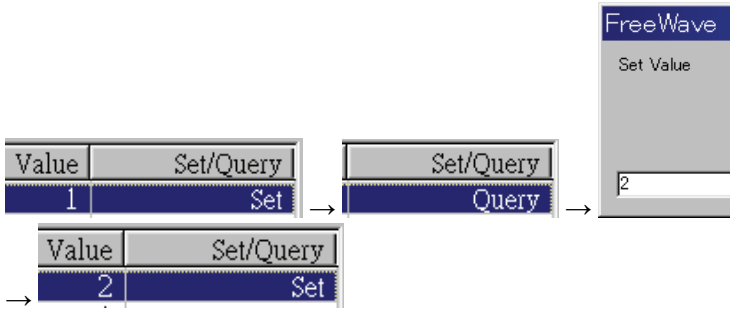
- To change from "Set" to "Query", simply double-click on the "Set/Query" row.



- To change from "Query" to "Set", double-click on the "Set/Query" row and then enter the setting value in the dialog box. The parameter mode changes to "Set" with a new value.



- To change the setting value, first change the mode from "Set" to "Query" by double-clicking on the row, then reset the value.



3. Click on the Play button. The commands run automatically in sequence and the returned values will be displayed in the "Value" row.

Command	Value	Set/Query
:AUT		Set
:MEAS:FREQ		Query
:MEAS:SOUR		Query

→

Command	Value	Set/Query
:AUT		Set
:MEAS:FREQ	0.000E+00	Query
:MEAS:SOUR	1	Query

Note

- For more details regarding each command, see the programming manuals.
- Commands relating to screen or waveform capture may not be available in Freewave.

Saving a Command List and its Result

1. Prepare a command list and/or run the commands.
2. To save the command list and its result, click on the Save button. The save file dialog box opens.

3. Select the file directory, enter the file name and save the list in CSV (*.csv) format.

Opening the file

A command list in CSV format can be opened using a spreadsheet application such as Microsoft Excel.

	A	B	C	D	E	F	G
1	:MEAS:SOUR	1	Query	Select the measured source channel.			
2	:MEAS:VMAX	-8.00E-04	Query	Return the value of maximum amplitude.			
3	:DISP:ACC	Close	Query	Select the accumulate display mode.			

File contents

- Command name
- Command result
- Mode (set or query)
- Command description

LONG MEMORY DATA CAPTURE (GDS-2000A/ GDS-1000A-U ONLY)

The Long Memory Data Capture function in Freewave directly transfers long memory digital waveform data (up to 2M) from the oscilloscope to the PC. Captured digital waveform data is stored in CSV format. CSV is compatible with most spreadsheet applications. The Data Capture function is used to:

- View oscilloscope waveforms
- Save waveform data

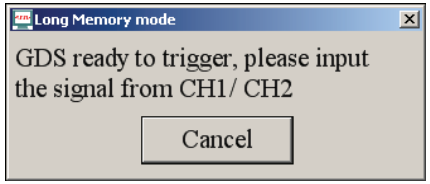
Viewing Long Memory Oscilloscope Waveforms

1. Activate Freewave and connect the oscilloscope to the PC. For details, see page20.
2. Select the Long Memory Data tab (last tab).

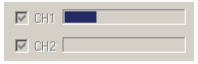
3. Choose the input channel(s).

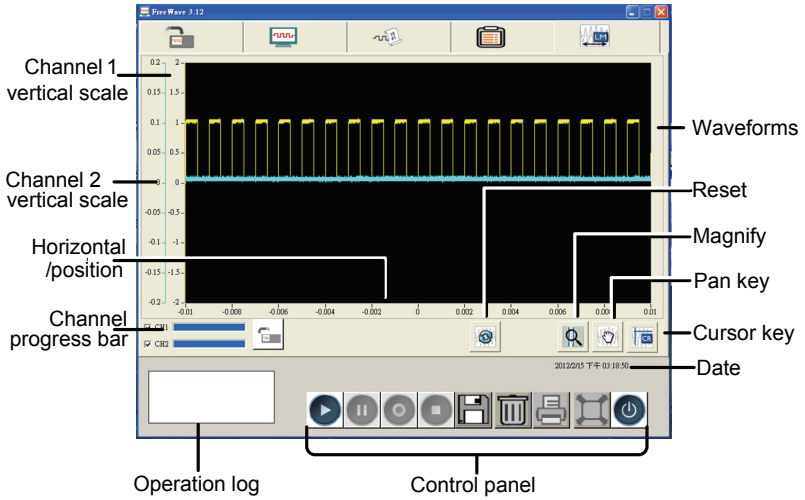
4. Press the play icon at the bottom of the screen.

5. Freewave will start capturing data as soon as a waveform is triggered. A dialog box will ask to input a signal to CH1/CH2.



6. Wait while the data is transferred to the PC. This is shown by a progress bar for each channel.

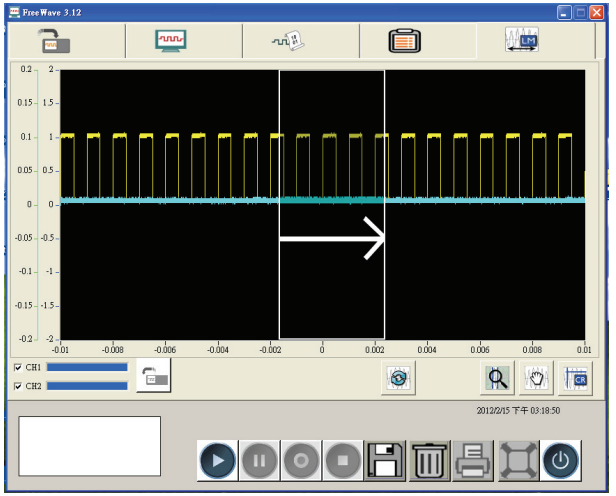




Zooming in or out

Click the Magnify key.

Create the area to be magnified by holding the left mouse button and dragging the cursor over the area to be magnified.

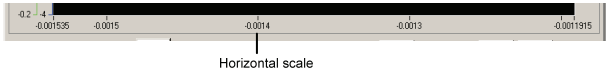


The waveform will be magnified to the size of the magnification area.

Horizontally moving a waveform

Click on the Pan key. To pan the screen, hold the left mouse button anywhere on the waveform screen and drag the waveform left or right.

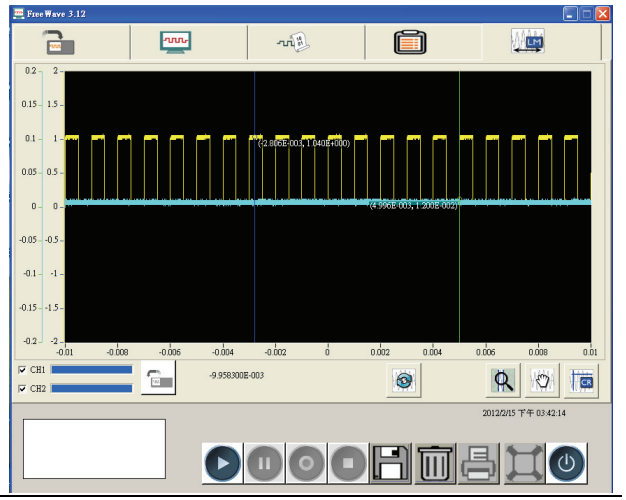
The horizontal scale will change accordingly.



Cursors

To position cursors on the waveforms, press the Cursor key.

To move a cursor, left click and drag either the cursor line or cursor point to the desired positions.



Reset Waveform	Pressing the Reset key will reset the waveform position and scale as well as remove the cursors.	
Clear waveforms	To clear the waveforms on the screen, press the Delete key.	

Saving Waveform Data

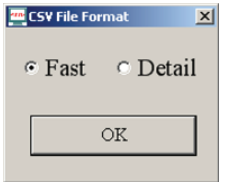
1. Make sure that there is a waveform in the Freewave screen.
2. Click on the Save button. A file save dialog box will appear.
3. Select a file name and location and save the data. The CSV data file stores the waveform data points as well as the oscilloscope identification. A *.csv file will be saved for each active channel. Each file will be appended with the channel number. For example: test →test1.csv, test2.csv

   Data file format • CSV (*.csv)

Data file contents
- Manufacturer
- Serial number
- Saved Date
- Model name
- Firmware
- Waveform Data

When saving files, you will get the option to save “Fast” or “Detail” waveform data. Fast data only contains amplitude data. Detail data also contains the time of each point relative to the trigger point.

4. Choose Fast or Detailed and click OK. The file will be saved.



Recalling Waveform Data

1. Click on the Recall button.
2. Select a file to recall from the file panel. A file can be only be loaded to the channel it was originally saved to.

   Data file format • CSV (*.csv)

   Data file contents
   - Manufacture
   - Serial number
   - Saved Date
   - Model name
   - Firmware
   - Waveform Data

   Both Fast and Detail file formats can be recalled. Standard memory and long memory files can also be recalled.