



WaveSketch User Manual

FINISAR®

Part Number 1238986

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**Important note: This guide covers operation of the WaveSketch
Application for WaveShaper S Series and M Series hardware.**

It is not valid for other hardware or software releases.

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1.1 Introduction

1.2 About this manual

Section 1: Manual Overview

1.1 Introduction

WaveSketch is a complementary tool to the WaveManager Suite of applications. This interactive graphic tool modifies the filter profile of a WaveShaper 120, 1000 or 4000 in real time. It allows the user to draw arbitrary filter shapes which get automatically uploaded to the WaveShaper. The modified filter profile can also be exported as a WaveShaper preset file (*.wsp) for loading into the WaveShaper at a later date.

1.2 About this manual

Section 2: Getting Started covers the WaveSketch Application Installation and guidelines.

Section 3: WaveSketch Overview describes each of the WaveSketch Graphical Interface Controls and Software response (e.g. when adding or removing WaveShapers while running WaveSketch).

Section 4: Using WaveSketch briefly describes how to use WaveSketch to modify a profile.

2.1 Safety Considerations

2.2 Laser Safety

2.3 Control Computer Requirements

2.4 Windows Installation

2.5 Linux Installation

2.6 Connecting the WaveShaper to other equipment

2.7 Start-up and Initialization

Warning

Section 2: Getting Started

2.1 Safety Considerations

All Safety considerations as described in the WaveShaper User Guide manual should be observed when working with WaveShaper equipment, in particular please observe the Laser Safety Guidelines also described in 2.2.

2.2 Laser Safety

The WaveShaper family of Programmable Optical Processors are designed for use with various classes of laser up to, and including, Class 3B lasers. Whilst the WaveShaper module does not generate laser light, laser light may be present on one or more output ports depending on the configuration of WaveShaper selected and the type of laser connected to the input port(s).

Please pay attention to the following laser safety warnings:

- **Under no circumstances look into the end of an optical output cable/connector(s) when the device is operational. If there is any laser radiation it could seriously damage your eyesight.**
- **Do not operate the WaveShaper without attaching the optical output connector(s) to a safely terminated mating connector(s).**
- **Refer servicing only to qualified and authorized Finisar personnel.**

2.3 Control Computer Requirements

The computer must have the **WaveManager** Application Suite used to control the WaveShaper **already installed**. The WaveSketch application requires at least:

- 400 MB of hard disk space
- 1GB of RAM

2.4 Windows Installation

- ! The installation requires Administrator rights on the target computer, but subsequent operation will require only standard user rights.
- ! The latest WaveManager package will automatically install the WaveSketch software. Please refer to WaveManager and the WaveManager User Manual for further information on how to install the packages

2.5 Linux Installation

WaveSketch is not available for Linux platforms.

2.6 Connecting the WaveShaper to other equipment

The WaveShaper has optical connectors for input and output. Care should be taken with optical interface cleanliness. Connector ends should be cleaned using isopropyl alcohol and a lint-free tissue, or proprietary connector cleaning cassette, before mating.

2.7 Start-up and Initialization

To start the WaveShaper, connect power to the WaveShaper, turn on the WaveShaper and ensure the front panel LED is lit (WaveShaper S-series only). At start-up, the WaveShaper will initially be set to a blocked state, where the output optical power is minimized.

Ensure the WaveShaper is connected to the computer using a USB cable and wait for the Windows USB device recognition process to complete. Start the WaveSketch Application.

It should be noted that the WaveShaper has a warm-up time of up to 10 minutes following start-up, during which time it will function correctly, but the performance is not guaranteed to meet all specifications.

When the WaveSketch Application Suite is started it will first configure all necessary drivers and communication ports, then identify and connect to the first detected Finisar WaveShaper device attached to the computer. Attempting to connect to a WaveShaper 100 would generate an error message as this family does not have attenuation control. The process of identification and connection to a WaveShaper does not change the current settings of that device.

Should no devices be connected or identified, the device identification Text Box in the WaveSketch Window would be left blank. WaveSketch can still be used to modify a preset data point file and save as a new preset data point *.txt file.

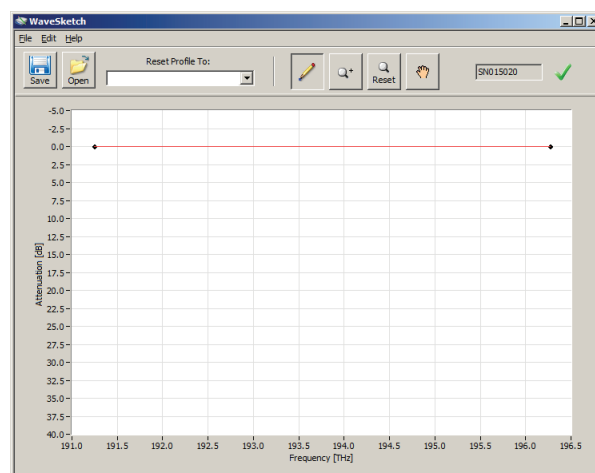


Figure 2.1 WaveSketch Opening Screen

Section 3: WaveSketch Overview

The WaveSketch Application provides a powerful and intuitive graphical user interface for controlling a WaveShapers' attenuation, phase, group delay or dispersion values across its frequency spectrum in real time. With the click of a mouse, users can create data points in the WaveShaper frequency spectrum and, based on the selection of the interpolation method between the data points, WaveSketch creates a visual representation of the profile which is loaded into the attached WaveShaper device in real time. WaveSketch provides graphical tools to create, drag and drop, single data points and area selected sets of data points. It has selected area zoom in and full view reset capability for the graphical view. The created filters can be saved as Preset Point Data text files for future use and exported as WaveShaper Profiles for later downloading direct to supported WaveShapers.

The WaveShaper 120 series in WaveSketch is limited to attenuation levels from 0 to 10 dB and does not support the control over phase, group delay or dispersion. Furthermore, WaveSketch does not support the WaveShaper 100 series. The WaveShaper 16000 is supported only in 4 x16 configuration

3.1 User Interface Overview

3.2 Adding a WaveShaper during program operation

3.1 User Interface Overview

The main functional sections of the WaveSketch are described below with reference to Figure 3.1

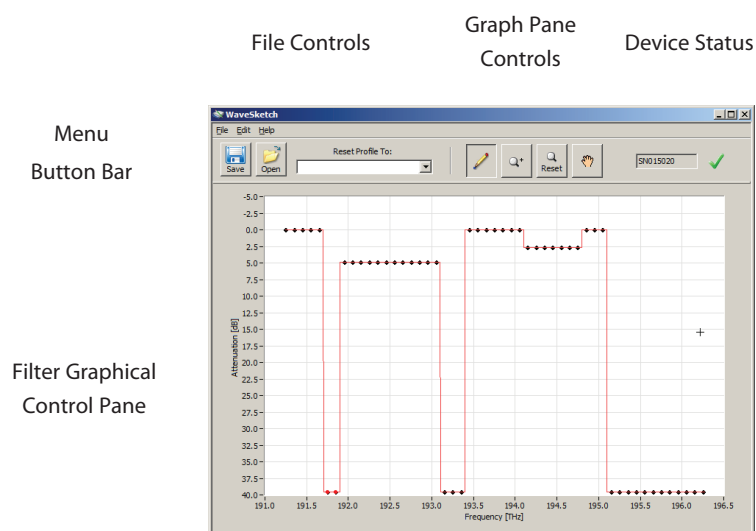


Figure 3.1 WaveSketch showing main controls

The main elements of the WaveSketch Application window are:

- Menu bar
- Button Bar - buttons for commonly used actions and device status information
 - File control/ Selection
 - Graphing Area Controls
 - Device and Connection Status
- Filter Control Pane- The Filter Control Pane starts with automatically generated Pass Through Filter for the range of the connected device or defaulted to WaveShaper C-Band Operating Range.

3.1.1 Button Bar

Provides short-cuts for frequently-used commands and device and status information. The areas of the button bar and actions of the buttons are as follows:

Button Bar File Controls

These controls provide quick access to load and save WaveSketch Point Data (*.txt) files.



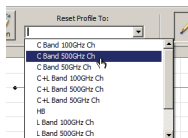
Save

Opens a "Save As" dialog box to allow user to save as a WaveSketch Preset Point Data (*.txt) file. Browser set to Preset folder as default.



Open

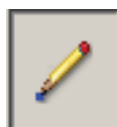
Allows the user to browse, open and load a saved WaveSketch Preset Point Data (*.txt) file. Browser set to Preset folder as default.



The "Reset Profile To" drop down list box allows the user to select and load a Preset Point Data File.

Button Bar Graph Controls

The graphing area allows the user to graphically create or modify filters with real time updates to the Attached WaveShaper Device. The following controls affect the operation and view within the graphing area.



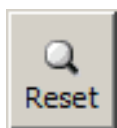
Sketch

Allows the user to manipulate point data within the graph area (e.g. create, drag, select).



Zoom In

Allows the user to select an area to zoom in on.



Restore Full View

Resets the Graphic View to Full Spectrum.

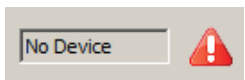





Move View

Allows the user to drag and move the view shown in both frequency and attenuation axes.

Button Bar Device Status

This applies to the currently connected WaveShaper. It will change appearance to show current device and communication status as shown in the table below.

	No Device has been recognised.
	Serial No of device which WaveSketch updates dynamically.
	Communication to the device has been established.
	Communication to the device has not been established or has been (temporarily) lost.

Please refer to Section 3.2 for further detail.

3.1.2 Menu Structure

WaveSketch provides access to many functions through drop-down menus as defined below.

File

N ew	Ctrl+N	Starts a new sketch with the start and end frequency data points set for the attached WaveShaper frequency spectrum - defaults to WaveShaper C-Band family if none attached.
O pen	Ctrl+O	Allows the user to open and load a saved WaveSketch preset data point file (*.txt) file.
Open W aveShaper (*.wsconfig)		
		Allows the user to connect WaveSketch to a specific WaveShaper. This may be required when Auto connect at start up does not detect the required WaveShaper, e.g. because more than one WaveShaper is connected to the pc and the first selected WaveShaper was not the required one.
Save A s...	Ctrl+S	Opens a dialog box to allow user to save the current WaveSketch as a WaveSketch Preset Data Point File (*.txt) for later use.
Export to .wsp		Exports the WaveShaper Profile (*.wsp) generated by the current WaveSketch for later loading directly onto a WaveShaper.
E xit	Ctrl+Q	Exits the program in the same manner as clicking the window control "x" button

Edit

Select **W**aveShaper Device

Allows the user to select an attached WaveShaper from the active WaveShapers listed.

Select **P**ort

Allows the user to select the port to direct the profile to.

Sketch **M**ode

Allows the user to specify the Sketch Mode. The available options are: Attenuation, Phase, Group Delay, and Dispersion.

Select **A**ll Ctrl+A

Selects all data points in the WaveShaper Spectrum Range. If the sketch tool is active, all data points can be moved together. If the graph is in sketch mode, this allows for all the data points to be moved in concert. Note that if the graph is currently zoomed in, then the data points outside the viewed area also selected, these data points will also be moved in concert.

Select **N**one Ctrl+Shift+A De-selects all data points.**D**elete Selected

Deletes all selected data points.

Select **I**nterpolation

Select the data point interpolation method for generating the WaveShaper Profile. The interpolation method can be selected from Nearest Neighbour, Linear, Cubic Hermite.

Lock **F**requency

Selecting this menu item toggles between locking graphical moves of selected data points to maintain their existing frequency settings so that only attenuation values change and unlocking the frequency move component so that data points can be freely moved in both Attenuation and Frequency axes.

Help


User Manual...

Opens the WaveSketch User Manual.

3.1.3 Filter Graphic Sketch Pane

The Sketch Pane is populated at start-up with the axes set to show the WaveShaper operating frequency range. If no WaveShaper is detected, the Sketch defaults to the WaveShaper C-Band Operating Range.





Data Points

Data Points are represented by . They may exist outside the Operating Range to allow required interpolation to the end of the operating range.

When Data Points are selected for graphical moves, they are represented by .

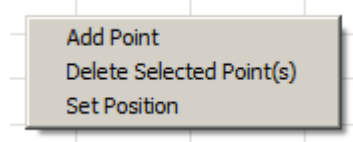
Cursors.

The following Table describes the meaning of the various cursors seen in the graphical pane:

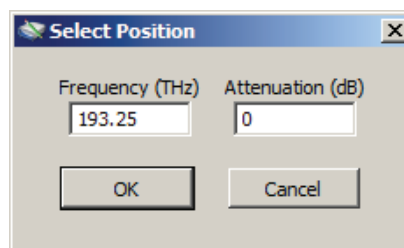
	In Sketch Mode, place cross hairs for position of data point and double left click to add point or right click to view data point menu. Left click and drag selects all data points in the area
	Select - On mouseover of a data point in Sketch mode, or on mouse left click and drag for area select in zoom mode, the cursor changes to a hand to indicate selection capability. Holding the mouse left button down allows you to drag a rectangular area to select the data points within.
	In Zoom mode - holding the mouse left button down allows you to drag a selection rectangle which will become the new Sketch pane view on release of the mouse button. You can still right click to add a data point using the right click menu.
	In Move mode - Holding the left mouse button down allows you to drag the view area displayed.

Right Click Menu

A right click on the mouse in the graphing area brings up the following menu.



"Set Position" caters for fine tuning a data point by direct editing of its frequency and attenuation values.



3.2 Adding a WaveShaper during program operation

The WaveSketch Application automatically registers active WaveShaper devices at start-up and connects to the first available device. Some models may require the user to first open the device using the File->Open WaveShaper menu to select the *.wsconfig file for the correct serial number.

Once Windows has successfully recognised and installed the USB driver, select the device to connect WaveSketch to using the Edit-> Select WaveShaper Device menu.

The Popup window is populated at time of opening. To see a device connected after the pop-up window has been displayed, it is necessary to close then re-open the window.

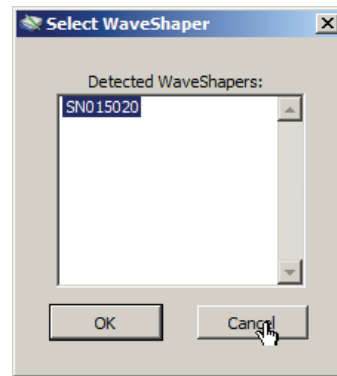


Figure 3.2 WaveShaper Device Selection

If a WaveShaper is attached that has not been previously installed on this machine, it will be necessary to close WaveSketch and run WaveManager with the new device powered up and connected. Please refer to the WaveManager user manual for help with configuring a new WaveShaper device. After configuring the WaveShaper with WaveManager, please close WaveManager and run WaveSketch.

Section 4: Using WaveSketch

The WaveSketch Application provides a powerful and intuitive graphical user interface for controlling a WaveShaper's attenuation, phase, group delay, or dispersion levels across its frequency spectrum in real time. With the click of a mouse, users can create data points in the WaveShaper frequency spectrum and based on the selection of the interpolation method between the data points, WaveSketch creates a visual representation of the profile which is loaded into the attached WaveShaper device in real time. WaveSketch provides intuitive graphical tools to create, drag and drop, single data points and area selected sets of data points. The created filters can be saved as Preset Data Point text files for future use and exported as WaveShaper Profiles for later driving of supported WaveShapers.

4.1 Setting Up

4.2 Adding Data Points

4.3 Moving Single Data Points

4.4 Moving Multiple Data Points

4.5 Locking the Frequency

4.6 Deleting Data Points

4.7 Zoom In

4.8 Change View Area

4.9 Reset View Area

4.10 Alternative Sketch Modes

4.11 Hints and Warnings

4.1 Setting Up

Connect your WaveShaper to the computer via the USB connector, then power up and wait for the USB device to be recognised by Windows before running WaveSketch. It is also possible to create preset files without a WaveShaper connected.

Start WaveSketch and wait for a few minutes to confirm your WaveShaper has been recognised.

WaveSketch initialises in Attenuation mode which allows the user to control the Attenuation. Details of other Sketch Modes can be found in Section 4.10.

The default interpolation method used by WaveSketch is to use Linear interpolation. To change the interpolation method use the Edit Menu:

Edit->Select Interpolation

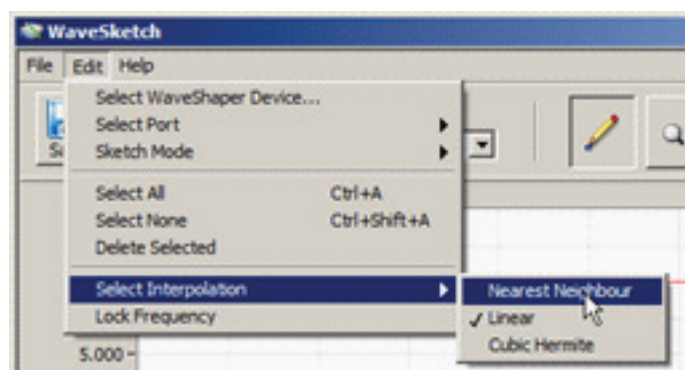


Figure 4.1 Setting WaveSketch Interpolation

The default port is Port 1. To select a different port use the Edit Menu:

Edit->Select Port

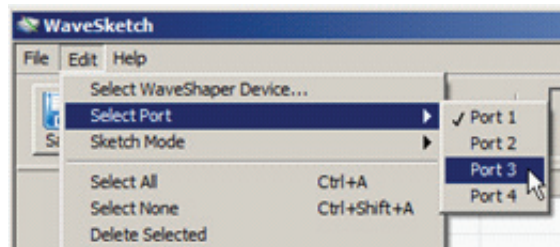


Figure 4.2 Setting WaveShaper Port

You can modify the profile, save it and re-open it either through the quick drop down list (Figure 4.3) or by using the "Open" button to browse to a different location.

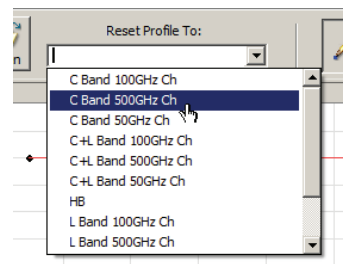


Figure 4.3 Preset Point Data (*.txt) file selection

4.2 Adding Data Points

With the pencil active, position the cursor where you'd like the new data point.

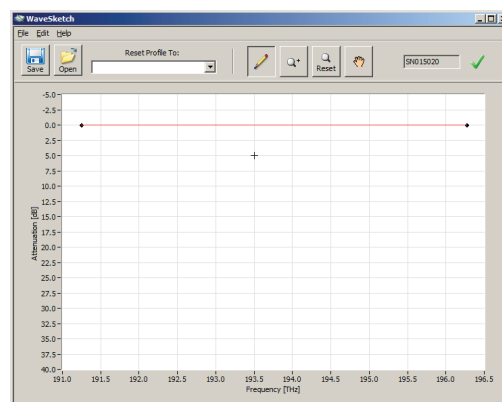


Figure 4.4 Position cursor for new data point

Double-click the left mouse button or alternatively right click and select "Add Data Point" from the right click menu.

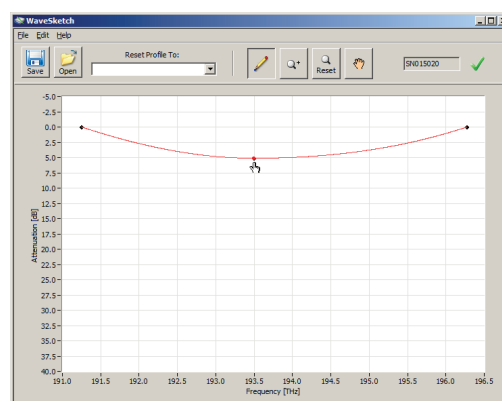



Figure 4.5 Double-click to add point data

4.3 Moving Single Data Points

Move the cursor to select a single data point (cursor changes to ) hold the left mouse button down and drag to the desired position, then release.

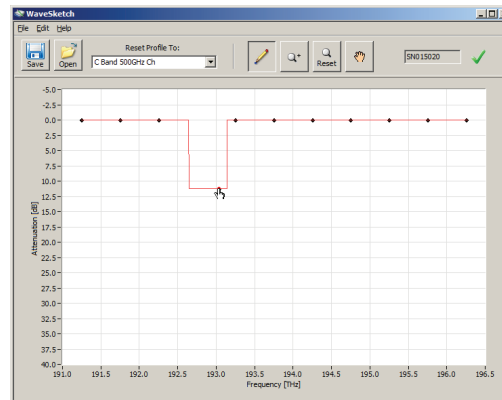



Figure 4.6 Move Single Point - Select and Drag

For fine control of the data point values right click and select Set Position (see section 3.1.3) to directly edit the frequency and attenuation values or zoom in to the desired axes scale (see Section 4.7), re-select sketch pencil and drag and drop the data point.

4.4 Moving Multiple Data Points

In the sketch pane, place the mouse cursor  at the top left corner of the area which will enclose the data points you wish to select, hold down the left button and drag to the bottom right of the area you wish to cover (Figure 4.7).

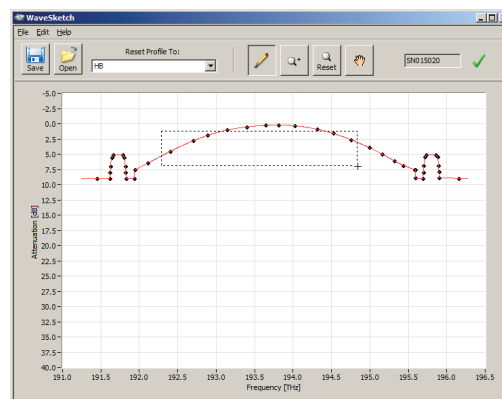


Figure 4.7 Select multiple points

On release of the mouse button, the enclosed data points will show red and can be dragged and dropped in the same manner as the single data point.

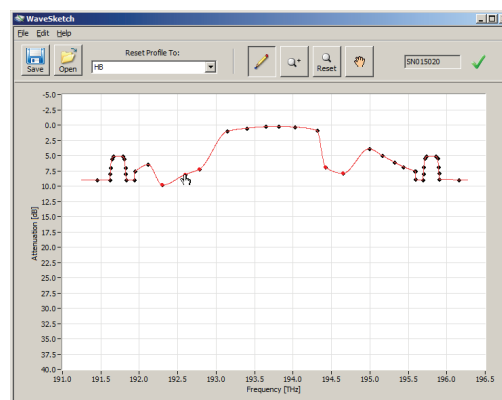


Figure 4.8 Drag and drop multiple points

4.5 Locking the Frequency

To avoid accidental changes to the frequency settings of the data points being moved, first lock the frequency using the 'Edit->Lock Frequency' setting. Now the drag and drop capability only allows for movement of each point in the y-direction. This remains true for subsequent data point movements (single or multiple selections) until the Locked Frequency mode is turned off. This is useful for adjusting the properties of a set of channels, where the location of channel edges is important.

4.6 Deleting Data Points

First select the single or multiple data points to be deleted. You may press the "Delete" key on the keyboard, use the menu Edit->Delete Selected, or right click the mouse and select Delete Selected Points.

4.7 Zoom In

Click on the Zoom in Button. 

In the graph area, position the cursor at the start of the zoom in area.

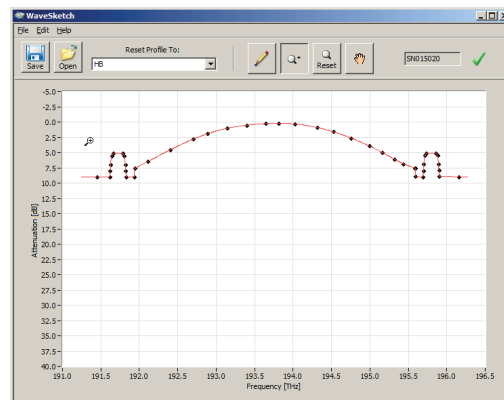


Figure 4.9 Start position for zoom select

Hold down the left mouse button and drag to show the rectangle area for zoom selection.

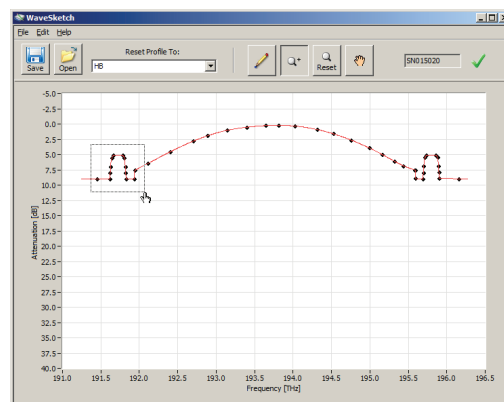


Figure 4.10 Drag to select zoom in area


Release mouse button. Once zoomed in, click the pencil button to resume editing.

4.8 Change View Area

Click on the Move button. 

In the graphing area, hold the left mouse button down and move the cursor to obtain the desired area views.

4.9 Reset View Area

Click the zoom reset button to restore both the graph area to the full spectrum, and the horizontal and vertical axes of the graph: 

4.10 Alternative Sketch Modes

The Sketch Mode specifies how WaveSketch should interpret the sketched profile. WaveSketch has four available Sketch Modes: Attenuation, Phase, Group Delay, and Dispersion. The currently active Sketch Mode can be shown and changed by selecting Edit -> Sketch Mode from the File menu. The desired mode can be selected using the Edit Menu:

Edit -> Sketch Mode

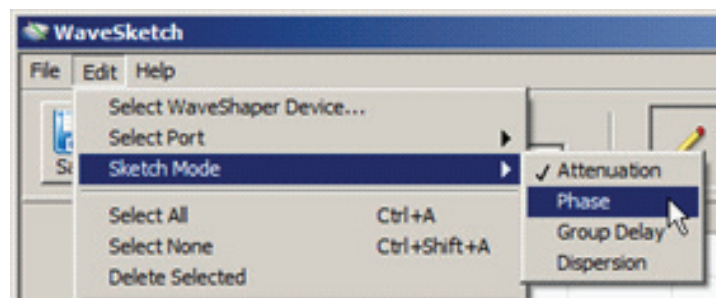


Figure 4.11 Setting Sketch Mode

4.10.1 Attenuation

When active, Data Points in the Sketch Pane are interpreted as attenuation values in units of dB. In this mode, the trace is drawn in red. This is the default Sketch Mode and the most commonly used.

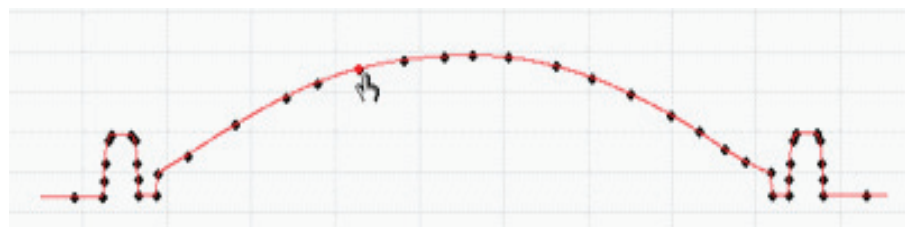


Figure 4.12 Attenuation Sketch Mode

4.10.2 Phase

When active, Data Points in the Sketch Pane are interpreted as phase values in units of radians. The trace is drawn in blue.

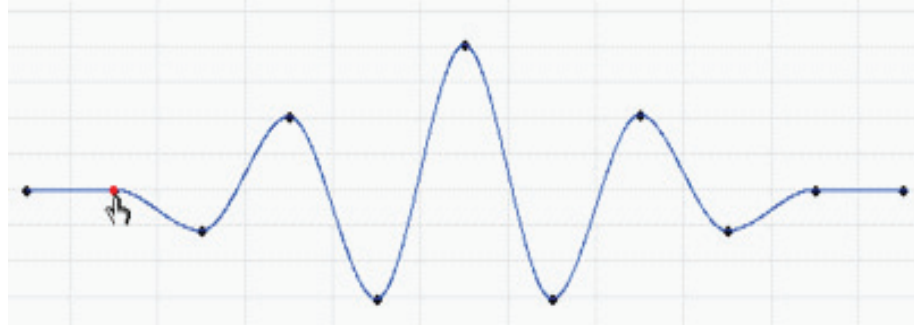


Figure 4.13 Phase Sketch Mode

4.10.3 Group Delay

When active, Data Points in the Sketch Pane are interpreted as group delay values in units of psec. The trace is drawn in green.



Figure 4.14 Group Delay Sketch Mode

Group delay (τ) is related to frequency (f) and phase (θ) and is defined by:

$$\tau(f) = -\frac{1}{2\pi} \frac{d\theta}{df}$$

WaveSketch configures the connected WaveShaper with phase values defined by:

$$\theta(f) = -2\pi \int \tau(f) \cdot df$$

where $\tau(f)$ is defined by the sketched profile.

4.10.4 Dispersion

When active, Data Points in Sketch Pane are interpreted as dispersion values in units of psec/nm. The trace is drawn in orange.

Dispersion (D) is related to frequency and group delay and is defined by the following equation:

$$D = \frac{d\tau}{d\lambda} = \left(\frac{f^2}{2\pi c} \right) \frac{d^2\theta}{df^2}$$

WaveSketch first calculates a group delay profile defined by:

$$\tau(f) = -2\pi c \int f^2 D(f).df + C$$

Where $D(f)$ is the sketched profile. The constant C is defined in such a way that the average group delay across the spectrum is zero. Finally, the WaveShaper is configured with a phase profile defined by substituting this equation into the formula for Group Delay in Section 4.10.3.

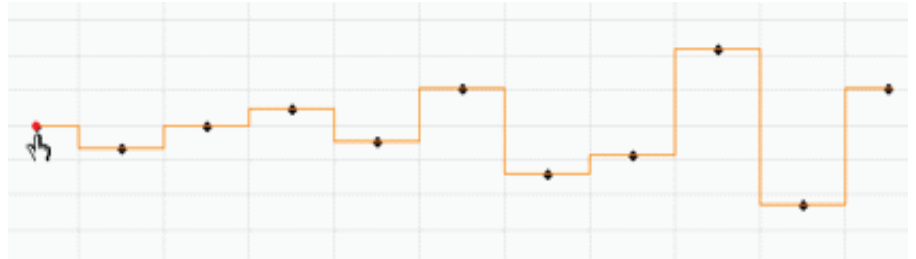


Figure 4.15 Dispersion Sketch Mode

4.11 Hints and Warnings

- WaveManager must be installed (and loaded at least once) prior to running WaveSketch.
- WaveSketch will automatically connect to the first WaveShaper it finds. The user can manually add or select a WaveShaper by using "File->Open WaveShaper". Older WaveShaper models may not be automatically detected.
- When a WaveShaper device is connected or switched on, WaveSketch needs to be restarted before the application can detect the device.
- It is not possible to import a *.wsp file into WaveSketch.



www.finisar.com/optical_instrumentation

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