VIDEOPOINT®
PHYSICS FUNDAMENTALS 1.0

USER GUIDE

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1. Introduction

VideoPoint: Physics Fundamentals is unique software designed to teach the fundamental laws of Physics using video-based motion analysis. The product is designed to assist in the teaching of introductory Physics and includes sample analyses, several related movies, and activities.

The video analysis process consists of collecting time and position data from each frame of a QuickTime movie and then reviewing the data in tabular or graphical form. Analysis features include velocity and acceleration calculations and graphing as well as curve fitting.

1.1. System Requirements

Macintosh

- OS X 10.2 or higher
- QuickTime 7 or later
- At least 250 MB of free disc space
- Adobe® Acrobat Reader ™

Windows

- Windows® 98SE, 2000, XP
- DirectX® 9 or higher
- QuickTime 7 for Windows®
- At least 250 MB of free disc space
- Adobe® Acrobat Reader ™

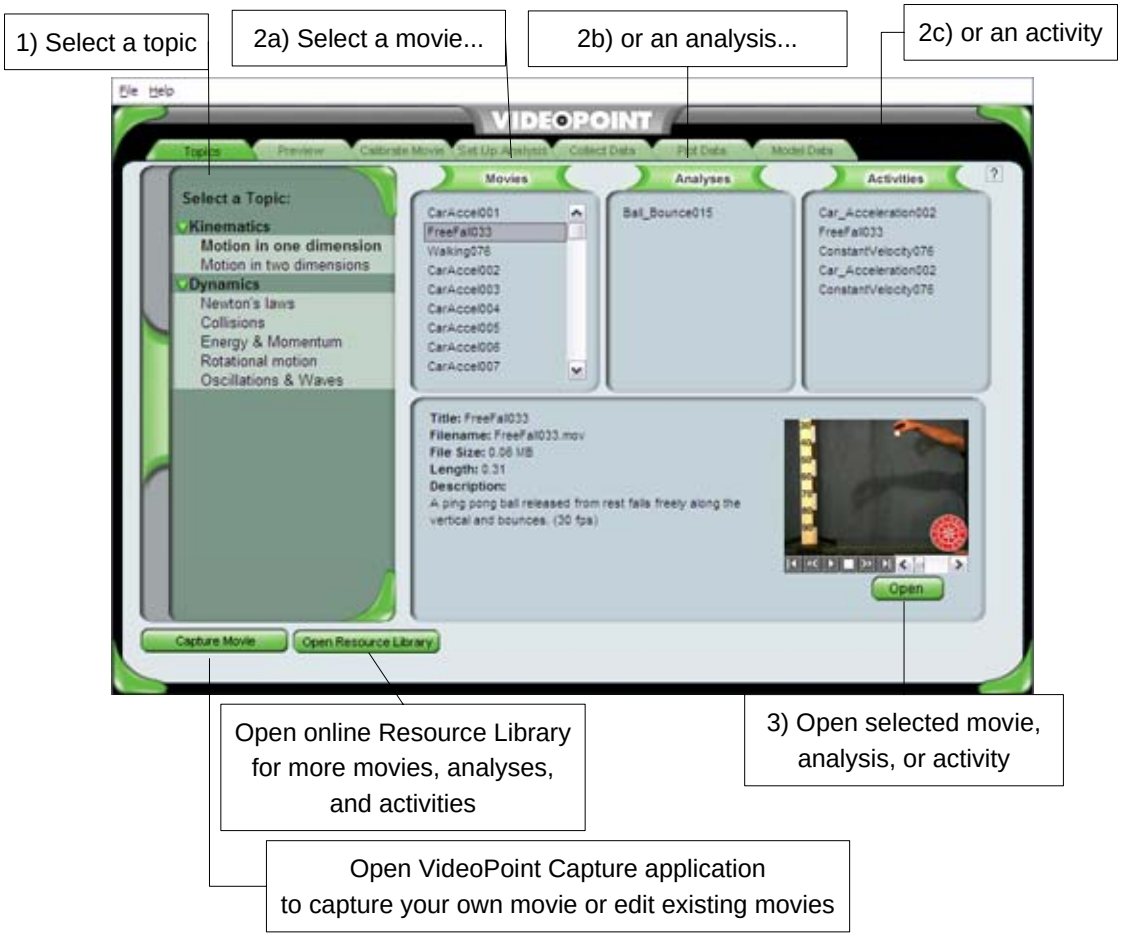
1.2. Installation

Macintosh: insert CD into the CD drive and double click the VideoPoint Physics Fundamentals icon. Double click *VPFunamentals.pkg* and follow instructions.

Windows: insert CD into the CD drive and follow instructions. If the disk doesn't autorun, double click on the file "setup.exe" first and then follow the installation instructions.

2. Using VideoPoint® Physics Fundamentals

2.1. Step 1: Select Topic



Select a topic from the list and then choose a movie, an analysis, or activity related to the topic by clicking on the title. You can read the description of the file and see a movie preview before opening the files.

Movie = a short movie relevant to the topic you've selected. You do the setup, data collection and analysis yourself.

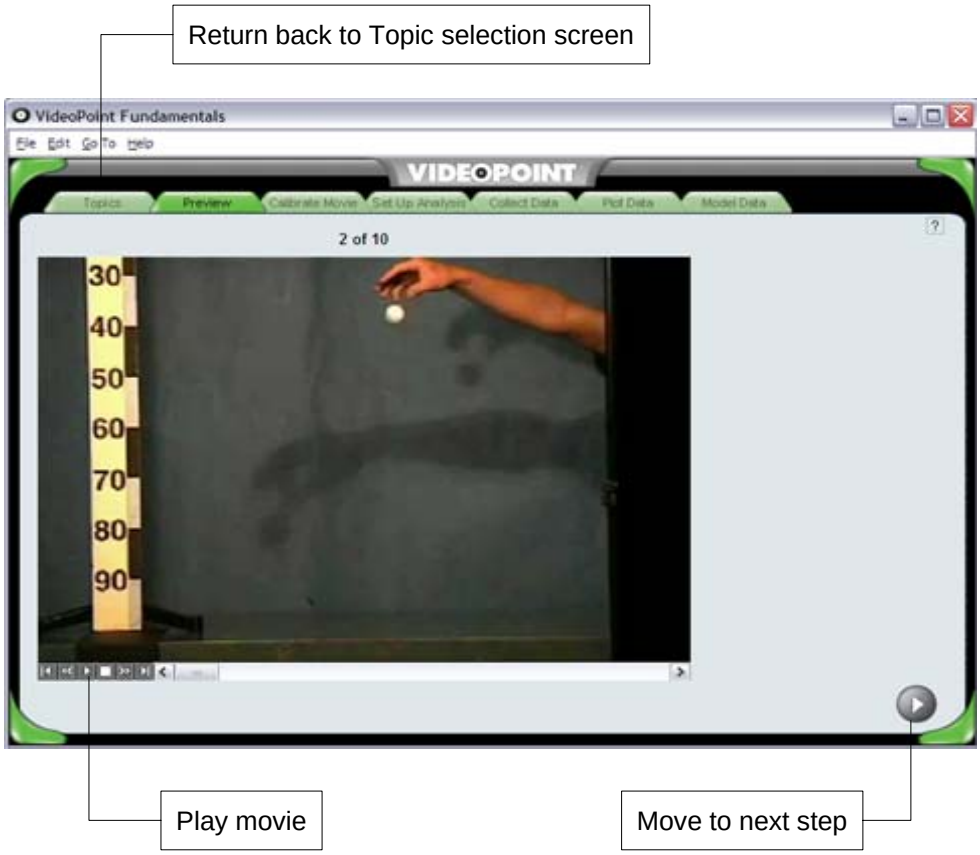
Analysis = a movie with analysis setup done and data collected for you. You go straight to analyzing the data.

Activity = a PDF file with step-by-step guide to a specific analysis relevant to the selected topic.

You can also capture your own movie by clicking on the ”Capture Movie” button or access the VideoPoint Resource Library online for more movies, analyses and activities.

For detailed instructions on how to capture your own movie, see ***Chapter 3: Using VideoPoint® Capture.***

2.2. Step 2: Preview Movie

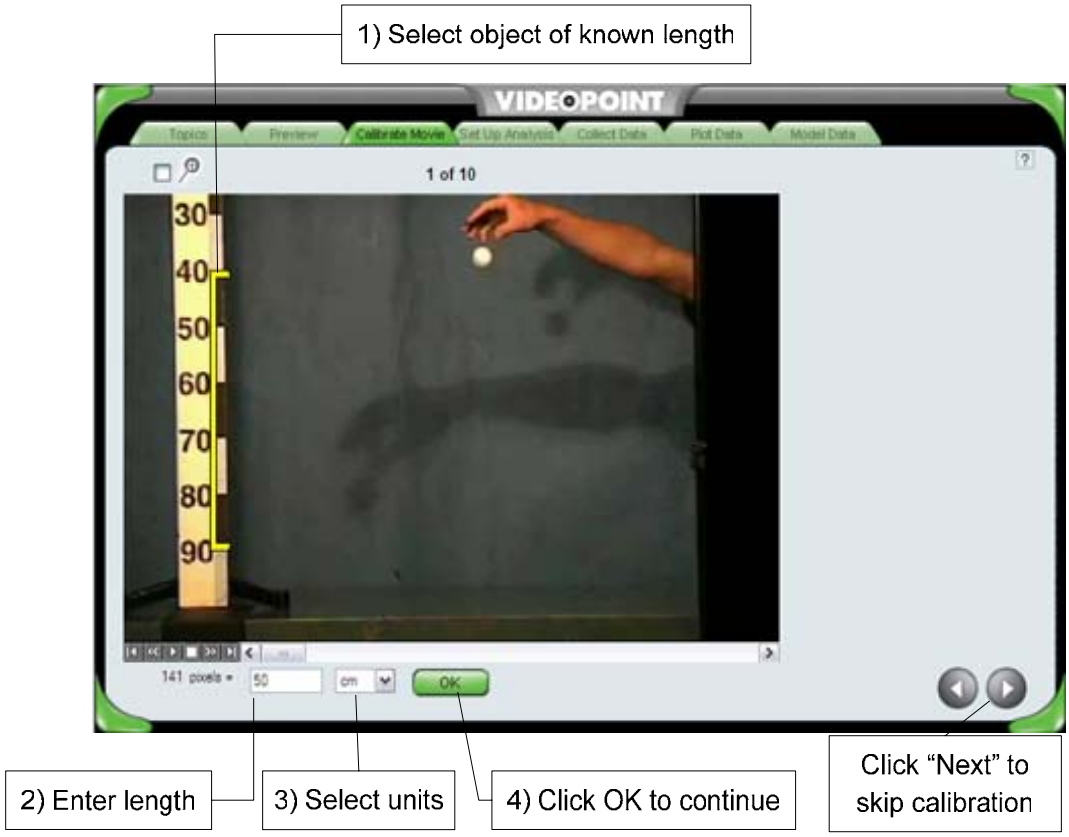


In this step, preview the movie before moving on to analyzing it.

- Play movie.
- Stop movie
- Rewind to first frame
- Fast forward to last frame
- Step back one frame
- Step forward one frame

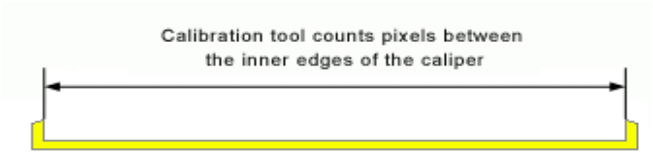
Press Next button or click on the “Calibrate Movie” tab to move to the next step.

2.3. Step 3: Calibrate Movie



In order to convert computer screen units (pixels) into physical length units (meters), the movie has to be calibrated. In other words, the scale factor that specifies the number of meters in the real scene per pixel on the video image needs to be defined.

1. Select an object of known length (for example a meter stick, a person, etc.) or the known distance between two features on a movie frame. It is imperative that the object be in the same plane as the motion of interest, otherwise, if the object is behind the motion, the scale factor will be too small.
2. Drag the ends of the yellow caliper on the movie screen to either end of this calibration object. For greater precision, you can zoom in on the movie by clicking the magnifier glass checkbox above the movie.



3. In the field below the movie, indicate the length that the selected object represents in the real scene.
4. Click OK to move to the next screen. You can return to this screen at any time to modify your scale. You can either adjust the caliper position or change the number or units in the fields below the movie.

When you make your own movies, make sure that your camera doesn't zoom and that you keep a scale reference object (e.g., meter stick, ruler) in the frame of the movie for calibration.

2.4. Step 4: Set up Analysis

The default coordinate system is a standard right-handed Cartesian system with the origin located at [20,20] pixels.

Move Origin:

To move the coordinate system origin, grab the circle around the origin and drag it to the desired location on the movie frame. Alternatively, enter the desired *x* and *y* coordinates in the Move Origin box and click Apply. To move the origin back to its default location, click the Reset button.

Rotate Axes:

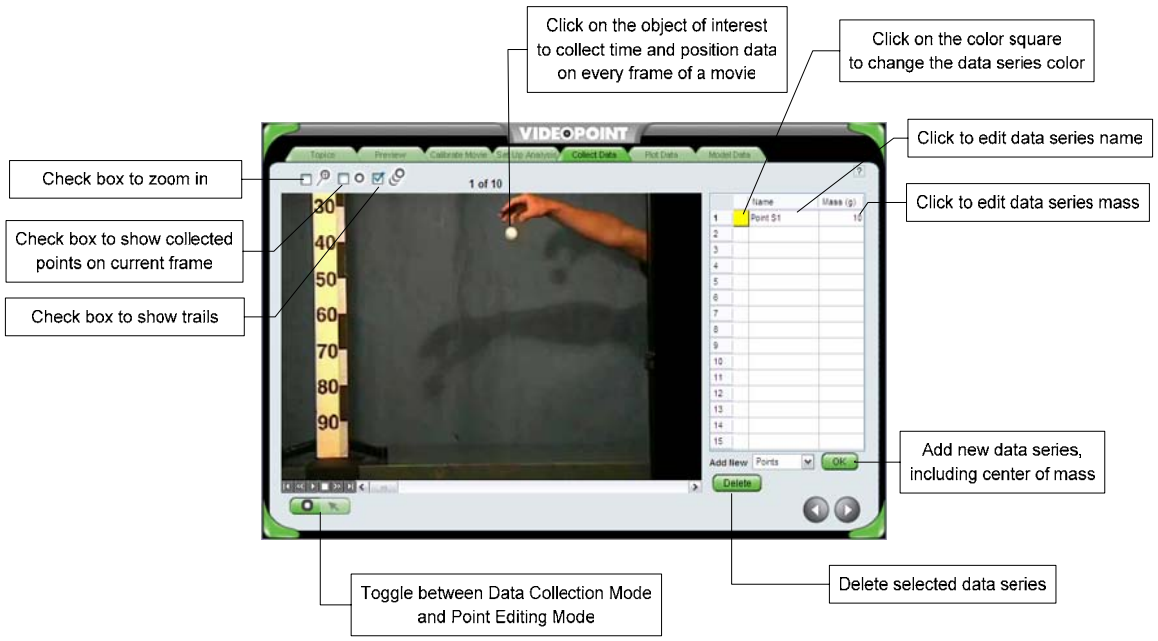
There are several cases in which it is advantageous to have an x-axis that is not horizontal. For instance, motion on an incline can be studied with the x-axis rotated so it is parallel with the surface of the incline. The coordinate system can be rotated through any angle between 0˚ and 360˚.

To rotate the coordinate system, click anywhere on either axis and drag it to the desired location. Alternatively, enter the desired degree value in the Rotate Axes box and click Apply. To move the axes back to their default location, click the Reset button.

Change t=0s:

By default, the time code of t = 0.0000s is assigned to the first frame of the movie. It is possible to assign this value to some other frame by entering the number of the frame to the field in the Set Clock box.

2.5. Step 5: Collect Data



Click on the object of interest in the first movie frame to collect the time and position data for this point. As you click, the movie will automatically advance to the next frame. Continue clicking on the object in each frame until the last frame of the movie. When you reach the end of a movie, a dialog box will appear that will let you choose whether to collect data for another object (new data series) or to continue to analyze the data you've just collected.

The table on the right side of the screen lists all data series you collect. It is possible to change the color, name, and mass of the selected data series by clicking in the appropriate field.

Adding New Data Series:

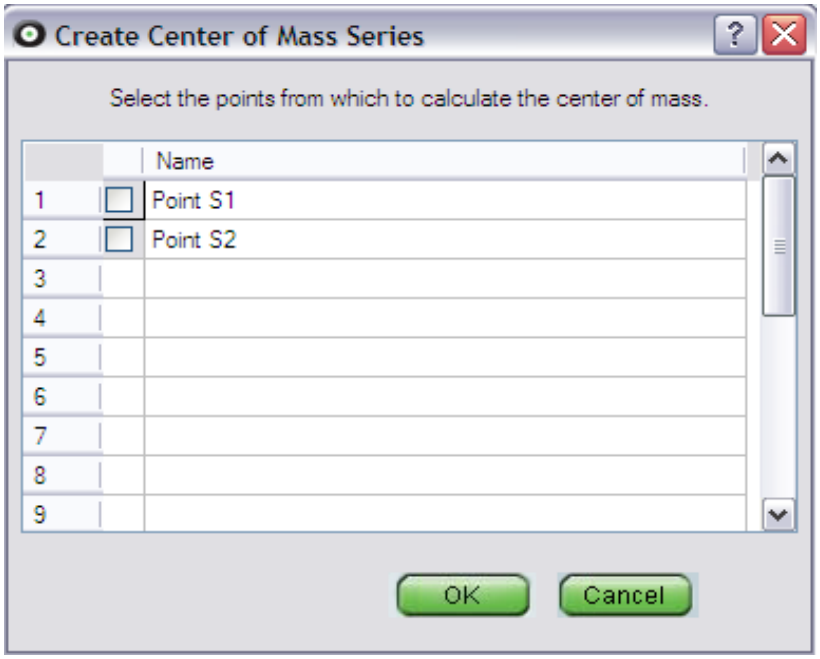
To add new data series (new point/object of interest), simply select "points" or "center of mass" in the drop-down menu next to "Add New…" and then click "OK".

Note: you must have created at least two data series from collected points before the option of adding center of mass becomes available.

When the new point appears in the data series table, start collecting points by clicking on the object of interest on each frame of the movie.

Creating the Center of Mass Data Series:

When you choose the option to add a new center of mass data series, a pop-up window will appear:



In this window, choose the data series (points) you wish to use in calculating the center of mass.

Deleting Data Series:

To delete a data series you have created, select it in the table (click on the name of the data series) and click the “Delete” button below the table.

Changing the Position of Points on Movie Frames:

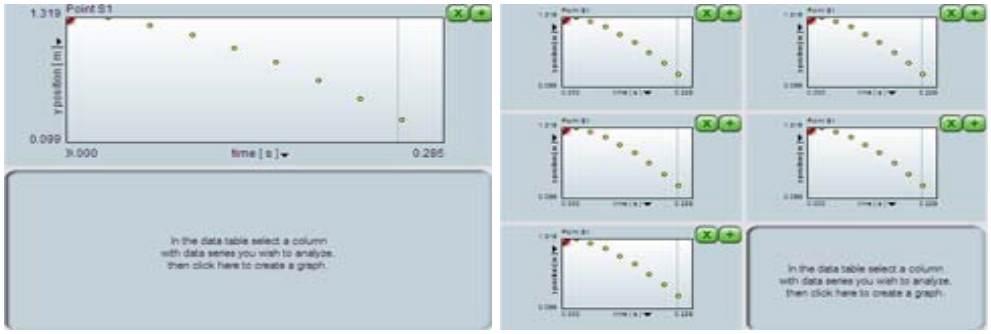
If you wish to adjust the position of a point on a movie frame, you can change from “Data Collection Mode” to “Data Editing Mode” by clicking on the toggle button below the movie:

When in the Data Editing Mode, click on the point you wish to edit and move it to its correct location on the movie frame.

2.6. Step 6: Plot Data

Creating Graphs:

In the Data Table select the data series for which you wish to create a graph (If you have collected data for only one series, it will be automatically selected.) Then click anywhere in the Graph Area to create a graph of *y* position vs. *time*. You can create up to six graphs by clicking in the remaining Graph Area spaces:



Editing Graphs:

All new graphs plot by default the *y*-position vs. *time*. To plot other variables, click on the *x* or *y* axis label to see a list of variables that you can plot:

- time
- x-position
- y-position
- x-velocity
- y-velocity
- x-acceleration
- y-acceleration

When you start creating graphs, your Data Table contains only the time and *x* and *y* position data. When you graph either velocity or acceleration on either axis, the values for these variables are added to the data table.

Changing the View of a Graph:

Maximize graph

Minimize graph

Delete graph

By clicking anywhere inside a graph and moving the cursor around, you can change the position of the *x* and *y* axes in the graph.

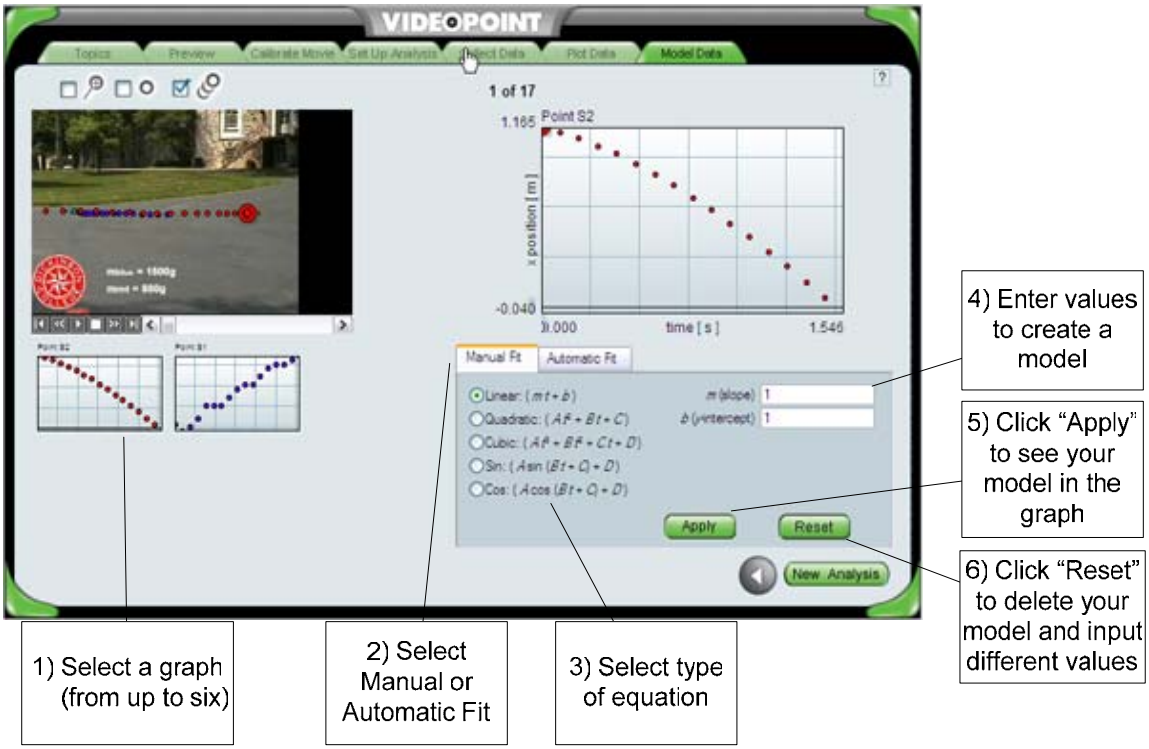
To zoom in on a graph click the “+” key on your keyboard. To zoom out, click the “-”key.

Resizing Movie, Data Table and Graph Area:

To change the portion of the screen taken up by either the movie, data table, or graph(s), you can resize these elements by positioning the cursor on the gray bar dividing these areas and dragging it to a different location. The cursor will look like this:

Note: Because the movie has to retain its aspect ratio, both the bars to the right and below the movie have to be moved far enough for the movie to double its size.

2.7. Step 7: Model Data



If you have created more than one graph during the Plot Data step, select the one you want to work with by clicking on its thumbnail below the movie.

By default, only Manual Fit option is available. In order to activate the Automatic Fit feature, go to Edit → Preferences and check the "Allow auto fit" option.

Manual Fit: Select the type of equation you want to model and enter the values for each variable. Click Apply to see the model in your graph. Click Reset to clear your equation mode.

Automatic Fit: Select an equation type and click Apply. All values get calculated for the best fit and the equation is displayed above your graph.

2.8. Getting Help

Every screen of *VideoPoint: Physics Fundamentals* contains a help screen with a short explanation of what to do at that particular step. Click on the  button to access this help.

For more help visit our Website at www.vpfundamentals.com or www.lsw.com/videopoint.

For free technical support email us at vpsupport@lsw.com or call us at 1-888-490-TECH (1-888-490-8324).

3. Using VideoPoint® Capture

VideoPoint® Capture software makes the process of capturing video from digital sources and converting them into analyzable VideoPoint® movies a snap. VideoPoint® Capture is compatible with most USB and FireWire video capture hardware on both the Macintosh and Windows® platforms. With this powerful software tool, real-world movies can be captured by your students, then analyzed using VideoPoint®.

Features:

- Capture movie
- Remove unwanted frames
- Add overlay image
- Save notes and credits with a movie
- Edit movies captured with another application
- De-interlace video to 60fps
- Open captured movies directly with VideoPoint® or VideoPoint Physics Fundamentals

VideoPoint Capture 2.1 User Guide

4. FAQs

1. What is the difference between *VideoPoint* and *VideoPoint: Physics Fundamentals*?

VideoPoint is a video analysis software package that allows users to collect position and time data from digital video in the form of "video points." Data is collected by clicking on the location of the items of interest for each frame of a QuickTime movie. It was developed in conjunction with the Workshop Physics curriculum at Dickinson College in 1995.

VideoPoint: Physics Fundamentals is a new version of this software, tailored primarily to high school and introductory college Physics students and teachers. It features a simplified interface and only the most commonly used analysis options taken from the original *VideoPoint*. Its main goal is to demonstrate the basic concepts in Physics using video analysis and to introduce teachers and students to *VideoPoint* and video-based motion analysis.

2. What is the difference between *VideoPoint* and *VideoPoint Capture*?

VideoPoint Capture software enables users to capture video from digital sources and convert them into QuickTime movies analyzable in *VideoPoint* and *VideoPoint: Physics Fundamentals.*

3. What do I need in order to use *VideoPoint: Physics Fundamentals* with *VideoPoint Capture*?

In order to use *VideoPoint: Physics Fundamentals* with movies that come integrated with the software, you only need the minimum system requirements:

Macintosh
- OS X 10.2 or higher
- QuickTime 7 or later
- At least 250 MB of free disc space

Windows
- Windows® 98SE, 2000, XP
- DirectX® 9 or higher
- QuickTime 7 for Windows®
- At least 250 MB of free disc space

If you want to take full advantage of the integrated *VideoPoint Capture* software, you will also need:

1. Digital Video Camera
2. FireWire, IEEE 1394 or i.Link connection

Digital Video Cameras: Most digital video cameras will work very well for VideoPoint analysis. Consumer level cameras come in two flavors, MiniDV and Digital8 (Sony only). Both formats will work. The digital camera must have an IEEE1394 interface. This is commonly known as FireWire or i.Link. For best results, the camera should have a way to set the shutter speed (often called Sport Mode or Shutter Speed).

FireWire, IEEE 1394 or i.Link Connection: FireWire, IEEE 1394 or i.Link are the same thing. Some computers have a FireWire connection built in, others need to add a PC Card, PCI Card or other adapter.

4. Why can't I add a center of mass to my data series?

The option to add a center of mass data series becomes available only after you have collected data for at least two points from which the center of mass values can be calculated.

5. Can I zoom in or out of a graph?

It is possible to zoom in on a graph using the "+" key on your keyboard. Be sure to have clicked inside the graph you want to zoom in on first. To zoom out, use the "-"key.

6. Why is automatic fit not available?

The automatic fit feature is hidden by default. To make it available, go to Edit menu and click on Preferences. Check the "Allow auto fit" option.

7. Where can I get more help with using VideoPoint: Physics Fundamentals or VideoPoint Capture?

Visit our Website at www.vpfundamentals.com or email us at vpsupport@lsw.com. We have also created a discussion group on Yahoo! Groups for you to share your ideas, questions, or suggestions with us and other *VideoPoint* users. To subscribe to this group, please send a blank email to: VideoPointUsers-subscribe@yahoogroups.com or go to the group homepage at http://groups.yahoo.com/group/VideoPointUsers/ and subscribe from there.

8. **Where can I find more movies, analyses or activities for use with *VideoPoint: Physics Fundamentals*?**

   We have created an online Resource Library accessible from our website and directly from *VideoPoint Physics Fundamentals*.

5. Technical Support

For FREE technical support, email vpsupport@lsw.com or call us at: **1-888-490-8324**

6. Credits

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