

UN-SCAN-IT™ Version 7.0

User's Manual for

Windows

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System Requirements

UN-SCAN-IT runs on IBM PC or 100% compatible computers with:

- Windows XP, Vista, Windows 7, Windows 8, Windows 10 (or newer)
- 256 MB or more of RAM memory
- 20 MB of free hard disk space
- Mouse (or compatible) pointing device
- Color graphics monitor at 800 x 600 resolution (or higher)
- Scanner, digital camera, other imaging device, or standard image files

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Table of Contents

Introduction	i
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Chapter 1: Software Installation

1.1	Overview	1
1.2	.NET Framework.....	1
1.3	Write Privileges	1
1.4	Installing UN-SCAN-IT on the Hard Disk.....	2

Chapter 2: Obtaining the Image

2.1	Overview	3
2.2	Scanner Operation	3
2.3	Original Size	4
2.4	Scanning the Image	4
2.5	Straight Scanning and Graph Alignment	5
2.6	Using a Digital Camera	6
2.7	Scan.....	6
2.8	Rotating the Image	6
2.9	Saving the Image	7
2.10	Removing Grid Lines from Graphs	8
2.11	Maximizing the Resolution of the Image.....	10
2.12	Maximizing the Resolution of the Digitized Data	10

Chapter 3: Running UN-SCAN-IT

3.1	Overview	11
3.2	Running UN-SCAN-IT	11
3.3	UN-SCAN-IT Registration Information.....	11

Chapter 4: File Options

4.1	Overview	13
4.2	Main Menu	13
4.3	Paste (x,y) Data from Clipboard	14
4.4	Load (x,y) Data	14
4.5	View (x,y) Data	15
4.6	Adjust X Data Spacing	15
4.7	Copy (x,y) Data to Clipboard	15
4.8	Save (x,y) Data	15
4.9	Clear (x,y) Data	16
4.10	Print (x,y) Data	16
4.11	Restore All Default Settings	16
4.12	Scan / Modify Image	16
4.13	Exit	17

Chapter 5: Digitizing (x,y) Graphs

5.1	Overview	19
5.2	Main Menu	19
	Digitize (x,y) Graph Image	20
	Return to Current (x,y) Graph Image	20
5.3	Open Image File	20
5.4	Graph Digitizing Mode	21
	Standard Line	21
	Intersecting Line	22
	Cyclic Graph	22
	Bar Graph/Mass Spec	23
	Dashed/Dotted Line	23
	Contour Plot	24
	Shapes/Drawings	25
	Symbols/Scatter Plot	25
	(x,y) Digitizing Tablet	26
	Polar Digitizing Tablet	26
5.5	Graph Digitizing Options	27
	Main Image View	27
	Color Type	27

	Scale.....	28
	Grid Line Filter.....	29
	Line Side Point Assignment.....	30
	Line Follow Direction.....	32
	Line Follow Algorithm.....	33
	Digitizing Speed.....	34
	Multi-Line Method.....	34
	Cyclic Line Follow Method Contour Line Start.....	35
	Cyclic Reversal Method.....	35
	Bar Graph Type.....	36
	Dashed/Dotted Line Follow Method.....	36
	Contour Line Follow Method.....	37
	Raster Scan Direction.....	37
	Manual Point Assignment Method.....	38
	Manual Automatic X Increments (Manual Mode).....	38
	Angle Units.....	39
5.6	Digitizing Screen.....	39
	Options.....	41
5.7	Positioning the Setup Icons.....	46
	Icon and Crosshair Movement.....	46
	Data Color.....	47
	Locating Axis Scaling Points.....	48
	Tilt Correction.....	51
	Locating Beginning Point.....	52
	Defining Vertical Limits.....	53
	Flat Spot / Line Thickness.....	54
	Locating Ending Point.....	55
	Variable Surface.....	56
	Pause Bars.....	56
5.8	Digitizing Modes.....	57
	Automatic Line Follow Modes.....	57
	Raster Scan Modes.....	58
	Manual Modes.....	59
5.9	Erasing Digitized Data Points.....	60
5.10	Shifting Data Vertically.....	61
5.11	Adjusting the X Spacing of the Data.....	61
5.12	Exporting the Digitized Data to Other Software.....	61

Chapter 6: Graphing / Modifying (x,y) Data

6.1	Overview	63
6.2	Main Menu	63
	Graph / Modify (x,y) Data	63
6.3	Cursor Movement	64
6.4	Graph Options	65
6.5	Graph Buttons	68
	Edit Point	68
	Insert Point	68
	Delete Point	68
	Erase Data	68
	Sort Data	69
	Expand	69
	Area	69
	Adjust X Data Spacing	70
	Smooth	71
	Derivative	71
	Least Squares	71
6.6	Help	72
6.7	Exit	72

Chapter 7: UN-SCAN-IT Help

7.1	Help Menu	73
7.2	Help	73
7.3	Customer Support	74
7.4	Show Startup Screen	74
7.5	Other Products	74
7.6	About UN-SCAN-IT	74

Appendix A: Scanning and Modifying the Image	75
Appendix B: Troubleshooting FAQs	77
Appendix C: New Version 7.0 Features	83
Glossary	87

INTRODUCTION

This Setup and User's Manual describes the installation and use of your UN-SCAN-IT Graph Digitizing Software. Chapter 1 provides information on the installation of the UN-SCAN-IT software. Chapter 2 describes some useful methods for scanning and saving your graphical images. Chapter 3 describes how to start the UN-SCAN-IT program on your computer.

The remaining chapters will introduce the UN-SCAN-IT software step by step and familiarize you with the features of the UN-SCAN-IT Graph Digitizing Software. This software was written by scientists, and is intended to be very intuitive, and almost entirely menu driven. In addition, context sensitive help buttons and menus are available throughout most of the digitizing and graphing portions of the software. It is recommended that the first time user consult the manual to become familiar with all of the features of the UN-SCAN-IT software.

This manual contains a glossary to explain some of the digitizing terms used throughout this manual, and a troubleshooting section (Appendix B) to help with some of the most commonly encountered digitizing questions. Previous users of the UN-SCAN-IT software may also wish to refer to Appendix C, which lists some of the newest features available with this version.

If you have difficulty obtaining or digitizing your own images, you may wish to practice on the sample images that are automatically installed into the UN-SCAN-IT folder. These sample images will assist you in setting up and digitizing an image for the first time. If you have further questions or need assistance, please contact customer support:

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The primary purpose of the UN-SCAN-IT software is to convert hard copy graphs and graphical images to digital (x,y) data. The graph must be available in a standard image format that can be obtained from a scanner or similar image input device (such as a digital camera). The image should be obtained

at an appropriate resolution, as the UN-SCAN-IT software will extract the underlying (x,y) data at *Full Scanner Resolution*. The data can be digitized using automatic or manual modes, and the digitized data can be exported into almost any spreadsheet or graphics program.

Image and Data Formats

UN-SCAN-IT accepts a number of different image file formats from scanners, image input devices, and standard image files. The images should be saved in one of the following formats:

- TIFF (.tif, tiff)
- JPG (.jpg, jpeg)
- Windows Bitmap (.bmp)
- PNG (.png)
- Gif (.gif)
- PCX/DCX (.pcx, dcx)
- Targa (.tga)
- Windows Metafile (.wmf)

The supported image formats are listed in the Open Image File dialog box when loading an image to be digitized.

Throughout this manual we will be giving instructions that include key sequences or menu selections that should be directly input into the computer. Specific items that should be typed or selected will be indicated in **Bold**. In addition we will refer to the mouse buttons as Left and Right, where Left is referring to the primary mouse button, while Right is referring to the secondary mouse button.

Although UN-SCAN-IT has many graphics and other auxiliary data options, it should be noted that the digitized data can be easily exported to almost any other commercial software program that accepts (x,y) ASCII Text data. The data can be exported by saving the digitized (x,y) data in ASCII format, or by copying the (x,y) data to the Clipboard and pasting the data directly into another software package. Although this manual uses the general term ASCII to refer to the standard data format for the digitized data, this format is also often referred to as TEXT (.txt) format.

Crosshair Movement

When digitizing (x,y) images, the crosshair used in the digitizing screens can be positioned using the mouse or keyboard arrow keys. Fine movements can be achieved using the keyboard **arrow keys**, while larger movements can be made by pressing the **Ctrl + arrow keys**. In addition, you may occasionally wish to restrict the crosshair movement to purely vertical or horizontal directions, which can be accomplished using the arrow keys (rather than the mouse).

Crosshair Magnification Window

The UN-SCAN-IT digitizing screen contains a crosshair magnification window (in the upper right corner), which displays a full scanner resolution view of the region surrounding the digitizing crosshair. This view should be used to obtain precise alignment of the crosshair when positioning the setup icons.

Accuracy

The UN-SCAN-IT software program is designed as a general tool for extracting data from images. As with any tool, the accuracy of the results can be largely dependent upon how that tool is used. The accuracy of the digitized data is not only a function of the software, but is also dependent upon the original conditions of the experiment, the quality of the image, as well as the set-up processes and interaction performed by the user. Additional inherent limitations exist in converting image information to digital data, and thus the accuracy and precision of the data should not be assumed by the user. Silk Scientific makes no representation or warranties with respect to the absolute accuracy of the digitized data or the fitness for any particular purpose. Please contact us if you have any questions regarding the accuracy of the results obtained using this product.

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Chapter 1

SOFTWARE INSTALLATION

1.1 Overview

The UN-SCAN-IT software should be installed in the Programs Files folder on your hard drive. The UN-SCAN-IT Setup program **setup.exe** should be used to install the UN-SCAN-IT files to your hard drive. The UN-SCAN-IT files have been compressed, and will not run properly if you simply copy the files to the hard drive or transfer the files from another computer without using the Setup program.

1.2 .NET Framework

The UN-SCAN-IT software requires the standard Microsoft .NET 4.0 (or higher) Framework to be present on the computer where the software resides. Most current Windows XP, Vista, Windows 7, Windows 8, and Windows 10 (or newer) systems will already have the .NET 4.0 Framework installed with the operating system. If this Framework is not present on the computer, the UN-SCAN-IT installation program will prompt the user to install the .NET 4.0 Framework.

1.3 Write Privileges

The UN-SCAN-IT software installation requires the current user to have write privileges when installing the software.

1.4 Installing UN-SCAN-IT on the Hard Disk

- (1) Insert the UN-SCAN-IT CD into your computers CD drive.
- (2) The installation program should run automatically, or you can select **Run...** from the Windows **Start** menu.

Type **D:\setup.exe** (if CD drive is **D:**) and select **OK**.

- (3) Follow the on-screen instructions until UN-SCAN-IT has been installed. The software will notify you when the installation is complete.
- (4) Finalize Installation: With the UN-SCAN-IT CD in your computer's CD drive, start the UN-SCAN-IT software from the desktop icon or programs menu. If you do not have the UN-SCAN-IT CD, or your computer does not recognize the CD, select the 'Bypass CD' option and follow the instructions.
- (5) The first time the UN-SCAN-IT software is run on your computer, you will be prompted to enter the Serial Number and Registration Number associated with your license (these numbers are generally located on the inside cover of the User's Manual). Once the registration process is complete, remove the UN-SCAN-IT CD and store in a safe place.

Chapter 2

OBTAINING THE IMAGE

2.1 Overview

Although the name of this software is UN-SCAN-IT, the image does not need to come directly from a scanner. The UN-SCAN-IT software can digitize almost any standard image format, and the image can come from a variety of sources (scanners, digital cameras, downloaded internet images, etc.). For simplicity, this chapter will give some guidelines for obtaining an image using a standard flat bed scanner. Virtually all scanners include their own scanning and image editing software. Before using UN-SCAN-IT, we recommend that you simply use the software that was included with your scanner to scan, edit, and save the image in a standard image format.

UN-SCAN-IT can directly import image files and digitize these images at full scanner resolution. In addition, if there is an image that can be displayed on your Windows computer screen, the image can be saved to the Windows clipboard by pressing the **Alt + Print Screen** keys, and the image can be converted to a file using the Windows Paintbrush or a similar program's Paste option (this method of creating files is limited to screen resolution).

2.2 Scanner Operation

There are a large variety of affordable scanner types and models currently available. Virtually all of these scanners can easily produce images of sufficient quality for accurate digitizing.

Graphical Images

The UN-SCAN-IT software can digitize color, grayscale, and black & white (line art) images. Color images are often most useful for distinguishing between lines or different colors; grayscale images are often best for graphs that contain background grid lines that are a lighter shade than the data line; and black & white (line-art) images are generally best for digitizing standard

black & white graphs that simply contain a dark data line on a white background.

For details regarding the actual use of your scanner and scanning software, refer to the User's Manual for your particular scanner and scanning software. Being familiar with your scanning software will help produce higher quality images and improve the digitizing results obtained using the UN-SCAN-IT software..

2.3 Original Size

Although UN-SCAN-IT can digitize images of virtually any size, scanning large originals can present significant difficulties. Generally, the graph should be of such size as to be easily scanned by your scanner (usually on 8½" x 11" paper or smaller). Some suggestions for dealing with larger originals include photo reducing the original, making use of a larger scanner, or using a digital camera.

To digitize long strip chart or recorder output it may be necessary to photo reduce the original, or divide the chart into scanning regions of more reasonable dimensions (e.g. 8" x 10" or smaller), as most scanners will not scan images larger than about 12" to 14". In this situation, scaling marks should be included on each portion of the image being scanned in order to insure continuity.

2.4 Scanning the Image

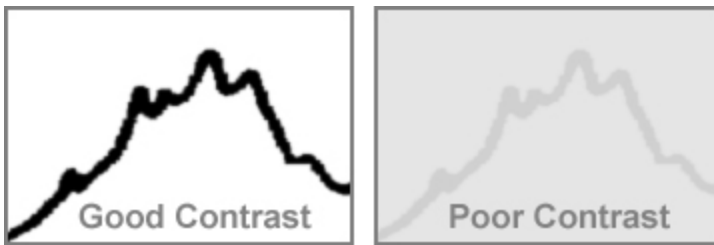
Many scanners have several possible 'image mode' settings. These settings are generally a selectable option contained within the scanning software. The preferred mode for scanning and digitizing most standard graphs is the black & white - line art mode (this mode is also referred to as 1-bit or black & white drawing). Although black & white images generally provide the sharpest images, color and grayscale images can also be useful for distinguishing colored data lines or filtering grid lines.

There are multiple resolution settings available with most scanners. Under

normal circumstances UN-SCAN-IT digitizes the image in units of one scanner unit resolution. Therefore a scanner setting somewhere between 100 to 300 dpi is generally sufficient to obtain good results for most images. You may wish to experiment with different scanning resolutions to determine which setting is most appropriate for your needs. Please note that increasing the scanner resolution may result in significantly larger files (e.g. a 600 dpi image takes 4 times the memory of a 300 dpi image).

Graph Contrast

When scanning graphical images, the scanner contrast control should be set in such a manner as to produce an image that contains a dark continuous data line (or data points), while producing a relatively clean white (i.e. minimum stray dark pixels) background.

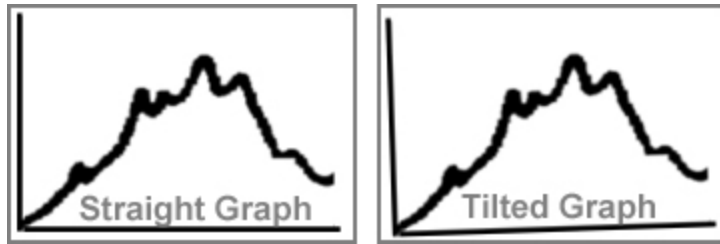


2.5 Straight Scanning and Graph Alignment

Although UN-SCAN-IT will compensate for slightly tilted graphs, the symmetry and appearance of the data may be affected. Therefore, it is recommended that the graph be scanned into the computer as straight as possible. This can be accomplished by simply making sure the edges of the paper (i.e. the axes lines of the graph) are parallel to the edge of the scanner bed.

If the image is skewed, most scanning software has a 'deskew' feature that allows the user to straighten the image (see your User's Manual for your particular scanning software). The deskew feature is only useful if the graph is evenly skewed and has no unevenly skewed (waved) regions. Particular

caution should be used when scanning a graph from a book or scientific journal, as uneven skewing may occur near the binding region of the graph.



2.6 Using a Digital Camera

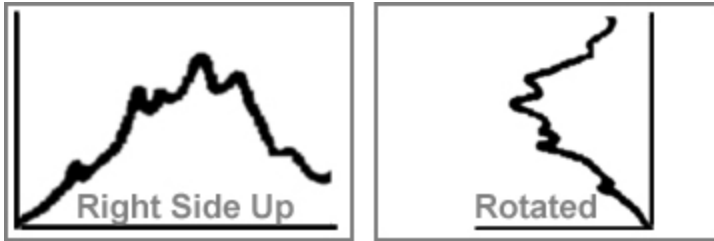
Consult the user's manual for your specific camera regarding instructions on how to obtain, store, and download your images. The images should be saved in a standard image format (TIF, JPG, etc.), and not in a proprietary format unique to your camera.

2.7 Scan

Now you are ready to scan/acquire the image. Consult the User's Manual for your particular scanning software for details on scanning images.

2.8 Rotating the Image

In order for UN-SCAN-IT to properly digitize the image, the image must be displayed 'right side up' on the screen before the image is saved. Virtually all scanning software has image rotation capabilities (consult your scanning software User's Manual for details on such features as *Rotate Clockwise* and *Rotate Counterclockwise*), thus the image can easily be rotated to the proper orientation.



2.9 Saving the Image

Once the image has been satisfactorily scanned (re-scan the image if it is too light, dark, wavy, etc.), the image should be saved in a standard image format so that it can be imported into UN-SCAN-IT. Acceptable image formats include, but are not limited to:

- TIFF (.tif, tiff)
- JPG (.jpg, jpeg)
- Windows Bitmap (.bmp)
- PNG (.png)
- Gif (.gif)
- PCX/DCX (.pcx, dcx)
- Targa (.tga)
- Windows Metafile (.wmf)

The scanning software may also allow you to select the image file color type when saving the image (e.g. line art, 8-bit grayscale, 24-bit color, etc.). The image should generally be saved as black & white (line art), however, color and grayscale mode can be very useful for certain types of images. The image format options are often contained in the Save As or Export menu options. See the User's Manual for your particular scanner for details on saving image files.

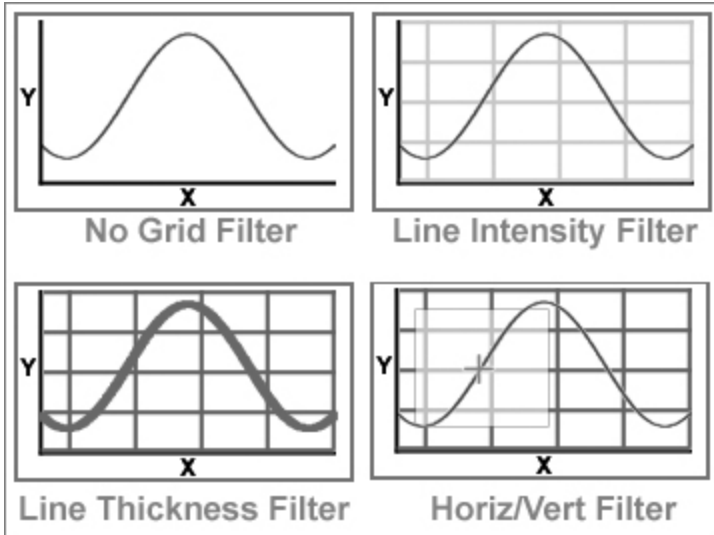
If you have images that have already been saved in image formats other than those accepted by UN-SCAN-IT, you may be able to read the image into your scanning software, and convert the image to a format compatible with UN-SCAN-IT.

Note: UN-SCAN-IT does not currently accept PDF files. PDF files often contain multiple pages, imbedded text, and variable dpi settings, which can present difficulties in extracting accurate and useful digitized data. The PDF file should be converted to a standard image format listed above.

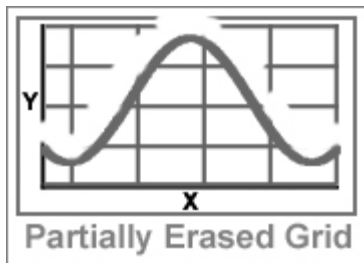
2.10 Removing Grid Lines from Graphs

Grid lines can present a difficult problem, as they overlap the data lines in numerous locations, and can interfere with the automatic line following process. Although UN-SCAN-IT has features for filtering grid lines during the digitizing process, it may be easier to simply reduce or remove the grid lines during the scanning process. The scanner contrast control setting can often be used to filter out the lighter and thinner grid lines, while continuing to register the darker data lines. By experimenting with this contrast adjustment, it may be possible to completely remove the grid lines from the image. If the graphical data is currently being collected by an (x,y) recorder, it may be possible to turn over the grid paper and digitize the data recording on the side that has no grid lines.

In addition, the UN-SCAN-IT software has three types of grid line filters available. One of the grid line filters uses the assumption that the grid lines are a lighter color/shade than the data line (to use this filter the image must be scanned in grayscale mode). The second filter uses the assumption that the grid lines are thinner than the data line. The third grid line filter uses the assumption that the grid lines run in a truly horizontal and vertical direction. These grid line filters are discussed later in this User's Manual.



If you are unable to remove the grid lines during the scanning process or the graph is not suitable for using the UN-SCAN-IT grid line filters, most scanners do have graphic editing tools (i.e. paintbrushes of various sizes), and these tools can be used to erase the grid lines where they intersect the data line. The UN-SCAN-IT software does have the option to simply follow along the top (or bottom) surface of the data line, therefore, you only need to erase the grid lines in the region slightly above (or below) the data line.



As an additional option for overcoming grid line difficulties can be to use the UN-SCAN-IT Manual Mode (similar to a digitizing tablet). In this mode, the

crosshair can automatically increment along the X-axis while the user controls the Y-axis movement with the keyboard arrow keys or mouse.

2.11 Maximizing the Resolution of the Image

When digitizing image files with the UN-SCAN-IT software, the resolution will generally be the same as the original resolution at which the image was scanned. Therefore, a 10-inch long graph scanned at 300 dpi will yield approximately 3,000 data points. Although some scanners operate at up to 1200 dots per inch (dpi) or higher, scanning graphs at these very high resolutions will generally not improve the quality of the data, because the resolution of the original graph is rarely above 300 dpi. In addition, scanning images at extremely high resolutions requires significantly more computer memory, disk space, and time (e.g. a 600 dpi image takes 4 times the memory of a 300 dpi image). Generally 100 to 300 dpi images are of sufficient resolution to provide excellent digitizing results, although you may wish to experiment with different scanning resolutions to determine which setting is most appropriate for your needs.

2.12 Maximizing the Resolution of the Digitized Data

Although the true optical resolution of the digitized (x,y) data from graphs is limited by the dpi resolution of the original image, the digitized data resolution can be further enhanced. By selecting the **Adjust X Data Spacing** option available in the *Graphing* portion of the UN-SCAN-IT software, a cubic spline (or linear) fit of the data can be used to increase or decrease the number of data points, by adjusting the X data spacing to user defined increments.

Chapter 3

RUNNING UN-SCAN-IT

3.1 Overview

This chapter describes how to start the UN-SCAN-IT program on your computer. Before the UN-SCAN-IT software can be used to digitize images, the image file should have already been obtained from a scanner, digital camera, internet image, etc. (see previous chapter for details).

3.2 Running UN-SCAN-IT

The easiest way to run UN-SCAN-IT is by simply double clicking the desktop icon that was created when the software was installed. You can also use the *Programs* option from the Windows *Start* menu, or you can open the UN-SCAN-IT folder and double click on the UN-SCAN-IT icon. The name of the UN-SCAN-IT executable file is **unscanit.exe**, and the folder location and name were selected during installation.

3.3 UN-SCAN-IT Registration Information

The first time the UN-SCAN-IT software is started, you should have the original UN-SCAN-IT CD in your computer's CD drive. If you do not have the CD, or your computer does not recognize the CD, select the 'Bypass CD' option and follow the instructions.

You will be prompted to enter Serial Number, Registration Number and User Name for your UN-SCAN-IT software license. The Serial Number and Registration Number are generally located on the inside front cover of the UN-SCAN-IT User's Manual (upgrades may contain the Serial and Registration Numbers on the front page of the User's Manual). You can enter whatever User Name you would like displayed. The UN-SCAN-IT software license is generally restricted to installation on one single computer terminal (unless multiple licenses or a site has been obtained).

Please return the Owner Registration card that is located in the front of the User's Manual, so that we may make you aware of any future product upgrades and assist you in your customer support needs. The UN-SCAN-IT software can also be registered online at www.silkscientific.com/contact.

Chapter 4

FILE OPTIONS

4.1 Overview

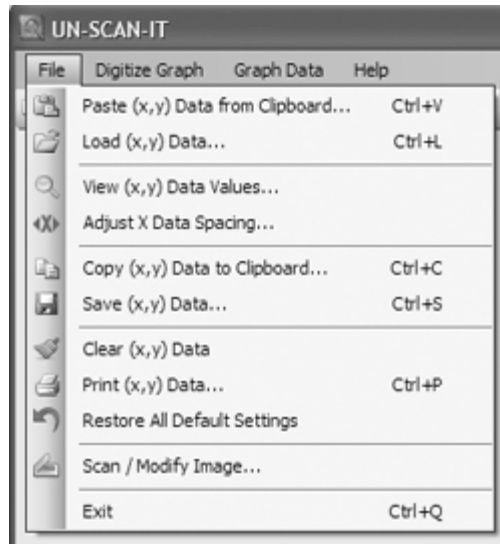
This chapter will guide you through the different **File** options present in the UN-SCAN-IT software. Some of these file menu options can also be accessed from the toolbar located below the menus.

Most of the File options will only be available after your graph has been digitized. See Digitizing (x,y) Graphs chapter.

4.2 Main Menu

To enter the **File** portion of the UN-SCAN-IT program from the main menu, select:

File



File Menu

4.3 Paste (x,y) Data from Clipboard

Select **Paste (x,y) Data from Clipboard...** to paste the contents of the Windows clipboard into the UN-SCAN-IT program. The data must be in a standard (x,y) column format with no text labels in order to be pasted properly into UN-SCAN-IT. Using this command clears whatever (x,y) data may currently be in memory, so you may wish to save your data before using this function.

4.4 Load (x,y) Data

Select **Load (x,y) Data...** to load a previously digitized (x,y) data file into UN-SCAN-IT. Do not use this option to load an image file for digitizing. The standard Windows file dialog box will appear. Loading a file erases all digitized data presently in memory, so you may wish to save your data before loading data. This software can load data saved by UN-SCAN-IT, or standard comma or tab delimited (x,y) ASCII Text data saved by other programs.

4.5 View (x,y) Data

Select **View (x,y) Data...** to view the current (x,y) digitized data values. Use the scroll bar to move up or down within the digitized data file.

4.6 Adjust X Data Spacing

The digitizing process converts scanner pixel units into user defined scaled units. The resulting X data spacing may appear arbitrary as a result of this conversion. However, the X data spacing can be adjusted by fitting the digitized data points using a cubic spline or linear fit. The X Data Spacing can be adjusted in the Graphing / Modifying (x,y) Data screen.

4.7 Copy (x,y) Data to Clipboard

Select **Copy (x,y) Data to Clipboard...** to copy all or part of the digitized data values to the Windows clipboard. The data can then be pasted into other Windows programs. Use the scroll bar to move up or down within the digitized data file. Drag the mouse (or hold down the shift key) to highlight the data, and then select **Copy** (all of the data can be selected by clicking on the row column heading or by pressing Ctrl+A).

4.8 Save (x,y) Data

Select **Save (x,y) Data...** to save the digitized data to a file. The data can be saved in tab or comma delimited ASCII Text format.

To export the digitized data into other spreadsheet or graphics programs, save the data in ASCII Text format with the appropriate file extension if required (e.g. sample.txt, csample.dat, sample.csv, etc.). Often the File Open dialog box for these programs will only display specific file types (e.g. .xls for Excel), however, other files can be displayed by selecting All Files *.* from the File Type drop down menu. Once the digitized data have been imported

by the other spreadsheet or graphics programs, you can then use all of the features associated with that software to analyze, modify, or graph the digitized data.

4.9 Clear (x,y) Data

Select **Clear (x,y) Data** to clear all the digitized data values from memory. In order to prevent accidental clearing of data, you will be prompted to confirm the Clear Data command.

The Clear Data command does not erase the digitizing settings, thus you may select **Return to Current (x,y) Image** from the **Digitize Graph** menu to continue digitizing the current image. When digitizing graphs, the Clear Data feature can be used to digitize multiple curves on a graph by digitizing each curve, saving the data, clearing the data, then returning to the current image to digitize the next curve.

4.10 Print (x,y) Data

Select **Print (x,y) Data...** to print the digitized data values. If you have any difficulties printing the data, save the data in ASCII Text format (or copy to the data to the clipboard), and export the data into your word processor or spreadsheet program for printing.

4.11 Restore All Default Settings

Select **Restore All Default Settings** to restore all of the UN-SCAN-IT settings to their original values when the software was first installed. This feature can be useful for restoring Window sizes, default colors, and default digitizing settings.

4.12 Scan / Modify Image

See **Appendix A**.

4.13 Exit

Select **Exit** to exit the UN-SCAN-IT software. You will be prompted to save any new data before exiting.

Chapter 5

DIGITIZING (X,Y) GRAPHS

5.1 Overview

This chapter will guide you through the digitizing process for graphical images, and explore the options available in the UN-SCAN-IT software. In this chapter you will be instructed to drag the setup icons and move the digitizing crosshair to different locations on the image. These movements can be accomplished with the mouse, the keyboard arrow keys for fine movement, or the **Ctrl** + arrow keys for coarse movements. Some of the options described in this chapter may not be encountered in every digitizing session.

Many of the UN-SCAN-IT digitizing menu options can also be accessed from the toolbar located below the menus. Help menus and context sensitive help buttons can be used to provide helpful information regarding the digitizing controls and options.

UN-SCAN-IT is designed as a general tool for extracting data from images. As with any tool, the accuracy of the results can be largely dependent upon how that tool is used. The accuracy of the digitized data is not only a function of the UN-SCAN-IT software, but is also dependent upon the original conditions of the experiment, the quality of the image, as well as the set-up processes and interaction performed by the user. Inherent limitations exist in converting image information to digital data, and thus the accuracy and precision of the data should not be assumed by the user. Please contact Silk Scientific if you have any questions regarding the accuracy of the results obtained using this product.

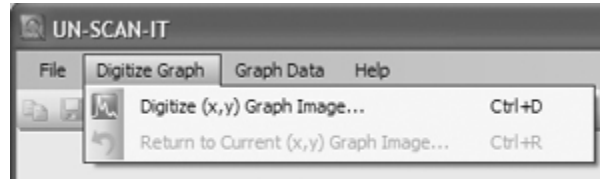
5.2 Main Menu

To enter the (x,y) graph digitizing portion of the UN-SCAN-IT program from the main menu, select:

Digitize Graph

Digitize (x,y) Graph Image - main menu

Select **Digitize New (x,y) Graph Image...** to digitize a graph that was saved in a compatible image format.



Digitize Graph Menu

Return to Current (x,y) Graph Image - main menu

Select **Return to Current (x,y) Graph Image...** to return to a currently selected graph and allow additional points on the graph to be digitized without requiring the re-entry of the graph's scaling points. All digitized data points currently in memory will be drawn to the screen, or the data points can be cleared by selecting **Clear Current (x,y) Data** from the **Options** menu in the digitizing screen.

5.3 Open Image File

If **Digitize New (x,y) Graph Image...** was selected from the main menu, a Windows file dialog box will appear (only acceptable image files with the appropriate file extensions will appear in the list of files that can be selected). Select the image you wish to digitize.

Sample Images

Several sample images are also included in the UN-SCAN-IT folder. You may find it useful to load and digitize one of these sample images before trying one of your own images. These sample images assist you in identifying the axis setup parameters, and are relatively straightforward to digitize.

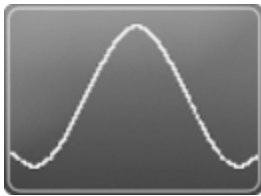
PDF Files

UN-SCAN-IT does not currently accept PDF files. PDF files often contain multiple pages, imbedded text, and variable dpi settings, which can present difficulties in extracting accurate and useful digitized data. The PDF file should be converted to one of the standard image formats listed earlier in this manual.

5.4 Graph Digitizing Mode

All UN-SCAN-IT digitizing modes (except Polar Digitizing Tablet) assume an (x,y) **Cartesian Coordinate** system where the x axis and y axis are **orthogonal** (right angles). UN-SCAN-IT does not digitize circular graphs or graphs that are recorded in a format other than standard (x,y) Cartesian Coordinates

The Graph Digitizing Mode allows you to select the type of digitizing to be performed on your image.

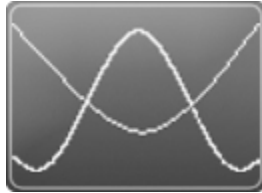


Standard Line

(Automatic Line Follow for Standard Curves)

In this mode, UN-SCAN-IT follows a line on the graphical image. The crosshair automatically searches up and down (as it moves along the line) until it finds the line and records the single valued (x,y) point. Then the crosshair automatically increments 1 resolution unit in the X direction, and repeats the point assignment process until digitizing is completed. The default *line follow direction* is left to right, and the default resolution is 1 scanner unit. These default settings can be modified in the **Options** portion of the Digitizing Screen. This mode is most useful for digitizing single line (x,y)

graphs or multiple curves that do not intersect. Extraneous points, marks and labels in the digitizing region generally do not present a problem unless they touch or overlap the curve of interest. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.



Intersecting Line

(Automatic Line Follow for Intersecting Curves)

This mode is the same as Standard Line, except that this mode includes features for dealing with intersecting curves. Pause Bars can be manually inserted along the curve, which cause the software to pause at these intersection points. Additionally, an overlap search can be used to automatically estimate the location of intersection points during the digitizing process. This mode is most useful for digitizing (x,y) graphs with multiple curves that intersect. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.

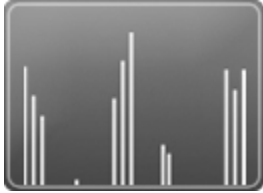


Cyclic Graph

(Automatic Line Follow with Auto Turn Around)

This mode is the same as Standard Line, except that the user is prompted to select a turn around point where the software automatically changes *Line Follow Direction* and *Line Follow Side* when the turn around point is

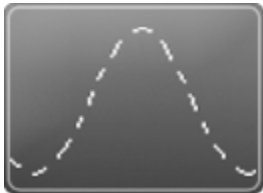
encountered. This mode is most useful for digitizing cyclic graphs such as cyclic voltamograms. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.



Bar Graph/Mass Spec

(Automatic Line Follow w/ Bar Graph Spacing)

This mode is the same as Standard Line, except that upon completion of the digitizing process for the curve/bar graph, the data can be converted to bar graph type values. This mode allows the data to be converted to discrete, evenly spaced-bar type values by finding the nearest X (and associated Y) value for each step along the X-axis. This mode is most useful for bar graphs such as mass specs. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.



Dashed/Dotted Line

(Automatic Line Follow with Interactive Line Limits)

This mode is similar to Standard Line, except the user will select a limited vertical search region that will be guided along the curve with the mouse. While the mouse button is depressed, the crosshair will automatically follow along the data line closest to the current position of the mouse cursor, and will not search beyond the vertical limits shown above and below the mouse

cursor. Additionally, the crosshair will not proceed horizontally beyond the current position of the mouse cursor. This process allows broken lines to be digitized without the crosshair jumping to another curve. This mode is most useful for graphs that contain one or more curves that are not continuous (such as dashed line, dotted lines, etc.). Extraneous points, marks, and labels in the digitizing region where the line is not continuous may present a problem and should be cleaned up during the scanning process. The digitizing process can be paused at any point by simply releasing the mouse button during digitizing.



Contour Plot

(Automatic Line Follow w/ Interactive Line Limits & Auto Turn Around)

This mode is the same as Dashed/Dotted Line, except when the crosshair encounters a location where no data line is present; the software automatically changes Line Follow Direction and Line Follow Side to follow the contour of the curve. This mode is most useful for digitizing non single-valued curves such as contour plots. The digitizing process can be paused at any point by simply releasing the mouse button during digitizing..



Shapes/Drawings

(Automatic Raster Scan w/ All Points Accepted as Data)

In this mode, UN-SCAN-IT searches an entire user-selected rectangular area in both the X and Y directions, and records the position of all of the data points in the specified region. This mode is most useful for digitizing shapes, figures, and drawings. Extraneous points, marks and labels in the digitizing region present a problem, and should be cleaned up during the scanning process. The data from the raster scan method are not vectorized and the data array is not in sequential order. This raster scan digitizing mode can fill memory very quickly as large numbers of pixels are digitized. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.



Symbols/Scatter Plot

(Auto Raster Scan w/ Contiguous Data Points Converted to Single Point)

This mode is the same as Shapes/Drawings, except that this mode searches the entire rectangular region specifically for groups of contiguous pixels, and records only the position of the center of each pixel group as a data point. This mode is most useful for images that contain scattered non-connected data points or symbols (e.g. circles, squares, etc). The digitized data is non-vectorized. Although this digitizing mode can be useful for scatter plots, it may be quite slow for some images. A faster alternative to this mode may be

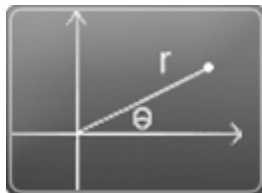
the Symbols option in Manual mode. The automatic digitizing process can be paused at any point by pressing the **Enter** key or selecting the Pause button.



(x,y) Digitizing Tablet

(Manual Mode for Standard (x,y) Coordinates)

In this mode, the user moves the cursor to each individual point on the graph that they wish to digitize, and presses the **Space Bar** (or right mouse button) to store each point. If the Automatic X Increments feature is selected, the crosshair automatically increments one resolution unit in the X direction after each point is digitized. In addition, a symbol mode option is available where simply clicking near a symbol/data point will cause the software to do a small raster search, and find the center of the data point. This mode is most useful for digitizing scatter plots, graphs, pictures, or drawings that cannot easily be digitized by any of the automatic digitizing methods.



Polar Digitizing Tablet

(Manual Mode for Polar Coordinates)

This mode is the same as (x,y) Digitizing Tablet, except that this mode is for digitizing graphs that have been recorded using a polar (r,theta) coordinate system. The user moves the cursor to each individual point on the graph that they wish to digitize, and presses the **Space Bar** (or right mouse button) to

store each point. In addition, a symbol mode option is available where simply clicking near a symbol/data point will cause the software to do a small raster search, and find the center of the data point. This mode is useful for digitizing any graph that contains polar (r,theta) coordinates. All other UN-SCAN-IT digitizing modes are for digitizing standard (x,y) coordinates.

5.5 Graph Digitizing Options

The Graph Digitizing Options allow you to select from the available UN-SCAN-IT digitizing options for the Graph Digitizing Mode you have selected. Only the options that are associated with the Graph Digitizing Mode selected will be displayed.

Main Image View – *graph digitizing options*

Maintain Aspect Ratio: This method maintains the original image aspect ratio in the main image viewing area. Although the image may not fill the entire viewing area, the image can be zoomed (1x, 2x, 4x, 8x, and 100%) to increase or adjust the size of the image within the viewing area. The zoom feature allows a closer inspection of the positioning of the setup icons, and also provides a more detailed view of the positions of the digitized data points. Note: Automatic Digitizing may be slower while image is zoomed.

Stretch to Fit: This method stretches the image to fill the entire main viewing window, making full use of the entire image viewing area. Although this method may cause some images to appear distorted, the actual digitized data values will not be affected by the stretching.

Color Type – *graph digitizing options*

Although UN-SCAN-IT automatically determines the default Color Type for the current image, this option can be used to modify the color type selection.

Black and White (Line Art): This type of image contains only black and white (no grayscale or color) pixels. This type of image requires the least amount of memory, and is often the easiest to digitize.

Grayscale: This type of image contains only grayscale pixels. The grayscale intensity range can be selected to limit the range of pixel intensities accepted as data, and ignore pixels outside that range.

Color: This type of image contains colored pixels. This type of image allows only pixels of a defined color to be digitized, and thus can differentiate between data lines (or points) based on color.

Digitize All Except Background: This color type digitizes all pixels, except for pixels of a defined background value. This can be useful in ignoring background and digitizing all other pixel values.

Scale – *graph digitizing options*

This option allows you to select the scale on which your original graph was drawn.

Linear: This standard type of graph contains linear scaling in both the X and Y directions. This is the most common scale for graphs.

Semi-Log (X-Linear): This type of graph contains linear scaling in the X direction, and logarithmic scaling in the Y direction.

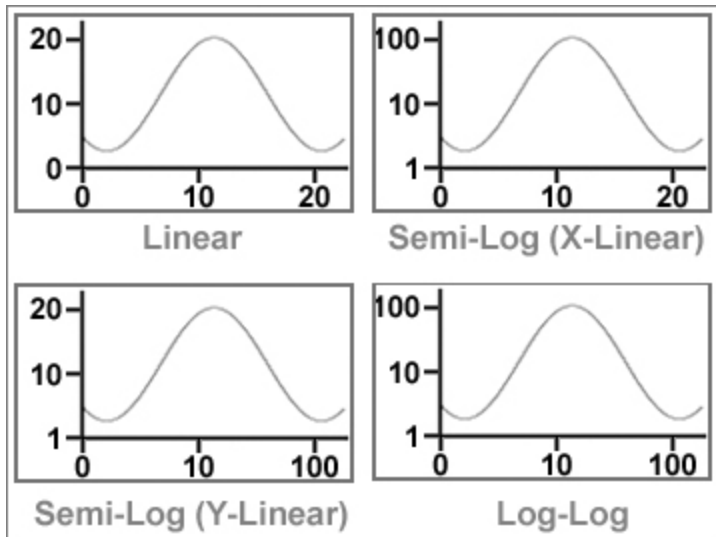
Semi-Log (Y-Linear): This type of graph contains logarithmic scaling in the X direction, and linear scaling in the Y direction.

Log-Log: This type of graph contains logarithmic scaling in both the X and Y directions.

Other Scales: Non-linear and Non-log formats must be input logically.

Example: Jan 1 to Dec 31 should be entered as Day 1 to Day 365

Example: 10:00am to 2:30pm should be entered as Hour 10.0 to Hour 14.5



Grid Line Filter – *graph digitizing options*

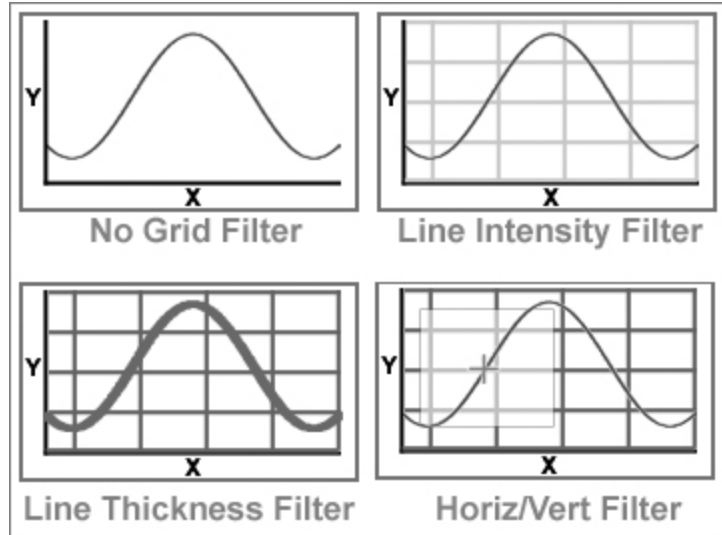
This option is used to filter out the background grid lines on the image so UN-SCAN-IT can follow the data line more easily.

None: This method provides no grid line filtering.

Line Intensity (Grayscale): This method provides grid line filtering based on the grayscale intensities of the data line being greater than the intensities of surrounding grid lines (requires grayscale image).

Line Thickness: This method provides grid line filtering based on the line thickness of the data line being greater than the line thickness of surrounding grid lines.

Horiz/Vert Filter: This method provides grid line filtering by ignoring horizontal and vertical lines within an adjustable search range.



Line Side | Point Assignment – *graph digitizing options.*

This option allows you to select the method that UN-SCAN-IT will use to follow the data curve and assign the exact location in (x,y) coordinates for each point. During the digitizing process, the UN-SCAN-IT software will draw a colored dot at each digitized data point location, and this dot can be used to gauge the accuracy of that particular point assignment method for your particular graph type.

Upper Surface of Line: This method follows the top surface of the data line, and then subtracts half the general flat-line thickness to estimate the middle of the data line... best for upward peaks.

Advantage: Very precise and accurate for graphs with upward peaks, and graphs with relatively flat curves.

Disadvantage: Does not correct for changing line thickness on sharp peaks, resulting in a maximum possible error on sharp peaks of up to one line thickness in any direction, and may have some problem properly following the bottom surface of sharp downward peaks.

Lower Surface of Line: This method follows the bottom surface of the data line, and then adds half the general flat-line thickness to estimate the middle of the data line... best for downward peaks.

Advantage: Very precise and accurate for graphs with downward peaks, and graphs with relatively flat curves.

Disadvantage: Does not correct for changing line thickness on sharp peaks, resulting in a maximum possible error on sharp peaks of up to one line thickness in any direction, and may have some problem properly following the top surface of sharp upward peaks.

Variable Surface of Line: This method follows the top surface when the data line is above a threshold, and the bottom surface when the data line is below a threshold... best for up and down peaks.

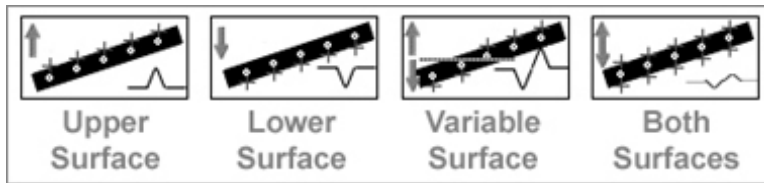
Advantage: Very precise and accurate for graphs with both upward and downward peaks.

Disadvantage: Does not correct for changing line thickness on sharp peaks, resulting in a maximum possible error on sharp peaks of up to one line thickness in any direction.

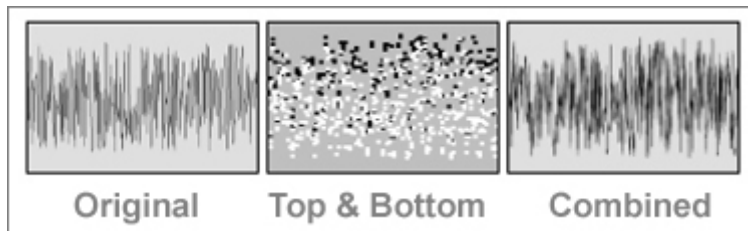
Both Surfaces (Mid-Line): This method follows both the top and bottom surfaces, and digitizes the average value... due to overlapping line thickness, this may greatly reduce peak heights.

Advantage: Very precise and accurate for estimating the center of the data line in regions where sharp peaks are not present, as this method corrects for changing line thickness throughout the graph.

Disadvantage: May cause peak heights to be significantly reduced for very sharp peaks, due to the lines becoming extremely thick at the top and bottom of sharp peaks.



If the data are extremely noisy, some of the data was lost when the noisy regions were originally printed. Although this data cannot be recovered, the noise can be approximated by digitizing both the top surface and the bottom surface of the data line. These combined data sets can then be sorted in the **Graph** portion of the UN-SCAN-IT software to best approximate the original data.

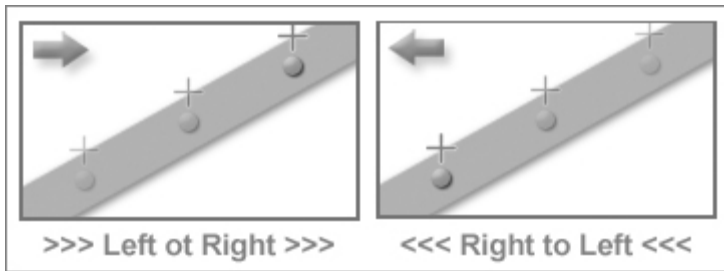


Line Follow Direction – *graph digitizing options*

The Line Follow Direction option allows you to choose the direction in which the crosshair will follow along the data line.

>>> **Left to Right** >>>: This method digitizes the data points from left to right across the image. The user defined ending point must be to the right of the user defined beginning point.

<<< **Right to Left** <<<: This method digitizes the data points from right to left across the image. The user defined ending point must be to the left of the user defined beginning point.

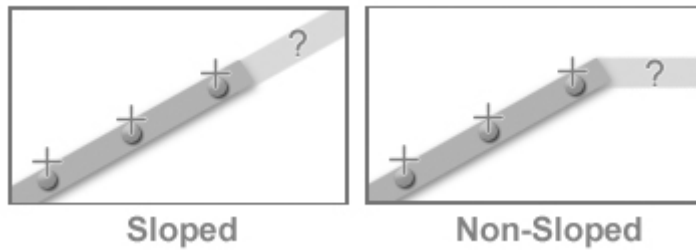


Line Follow Algorithm – *graph digitizing options*

This option is to estimate the location UN-SCAN-IT will use to begin searching for the next sequential point along the curve.

Sloped: This method estimates the location of the next point along the data curve based upon the slope of the previous points, resulting in faster line digitizing.

Non-Sloped: This method simply moves horizontally to estimate the location of the next point along the data curve, resulting in slower and more controlled line digitizing.



Digitizing Speed – *graph digitizing options*

This option is set the digitizing speed used during the automatic digitizing process.



Fast: The faster digitizing speeds provide identical results to the slower speeds, but may present difficulty in allowing user interaction (pausing, backing up, erasing data points, manual digitizing, etc.) due to the rapid speed.

Slow: The slower digitizing speeds provide identical results to the faster speeds, and allow easier user interaction (pausing, backing up, erasing data points, manual digitizing, etc.) due to the slower speed.

Turbo: This mode does not display the crosshair movement, digitized data points, or the data spreadsheet as the points are being digitized. This mode should only be used when maximum digitizing speed is required and no user interaction will occur.

Multi-Line Method – *graph digitizing options*

This option determines the method used by UN-SCAN-IT digitize graphs with intersecting lines.

Manual Pause Bars: This method allows the user to place Pause Bar icons at the line intersection points. The UN-SCAN-IT software will pause when it encounters these icons.

Overlap Search With Auto Pause: This method causes the UN-SCAN-IT software to pause automatically when an overlapping line is encountered.

Overlap Search With Auto Continue: This method causes the UN-SCAN-IT software to estimate a probable continuance point, and skip to that point, when an overlapping line is encountered.

Cyclic Line Follow Method | Contour Line Start – *graph digitizing options*

This option determines the starting Line Follow Direction and Line Follow Side when digitizing cyclic graphs or contour graphs.

Follow Upper Surface >>> Left to Right >>> then Reverse: This mode starts at the leftmost point's upper surface, reverses at the rightmost point, and finishes back at the leftmost point.

Follow Upper Surface <<< Right to Left <<< then Reverse: This mode starts at the rightmost point's upper surface, reverses at the leftmost point, and finishes back at the rightmost point.

Follow Lower Surface >>> Left to Right >>> then Reverse: This mode starts at the leftmost point's lower surface, reverses at the rightmost point, and finishes back at the leftmost point.

Follow Lower Surface <<< Right to Left <<< then Reverse: This mode starts at the rightmost point lower surface, reverses at the leftmost point, and finishes back at the rightmost point.

Cyclic Reversal Method – *graph digitizing options*

This option determines the method used for reversing at the turn around point when digitizing cyclic graphs.

Auto Reversal at Turn Around Point: This method automatically reverses the Line Follow Side and Direction when the turn around point is encountered, and then continues automatically.

Pause at Turn Around Point: This method automatically reverses the Line Follow Side and Direction when the turn around point is encountered, and then pauses.

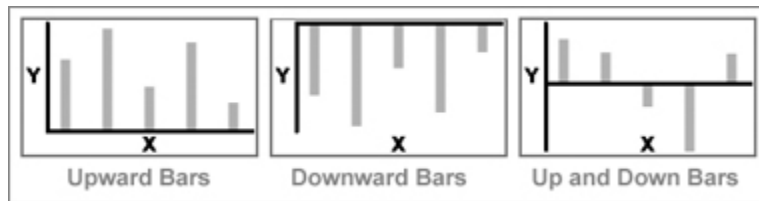
Bar Graph Type – *graph digitizing options*

This option allows you to select the type of bar graph to be digitized. UN-SCAN-IT only digitizes bar graphs that contain vertical bars.

Upward Bars: This method follows the top surface of the bars in a vertical bar graph.

Downward Bars: This method follows the bottom surface of the bars in a vertical bar graph.

Up and Down Bars: This method follows the top surface of the bars when the bar value is above a user defined threshold, and the bottom surface when the bar value is below the user defined threshold.



Dashed/Dotted Line Follow Method – *graph digitizing options*

This option allows you to select the method used to follow a dashed/dotted line, and to select the vertical search window size used for the digitizing process.

Semi-Automatic - Interactive Vertical Limits: This method requires the user to guide the digitizing cursor and associated vertical limits along the data line as the data points are being automatically digitized. The Vertical Search Window setting determines the vertical limits of the search window in which data can be digitized.

Automatic - Auto Estimating Vertical Limits: This method causes the software to automatically move the digitizing cursor and associated vertical limits as the data points are being automatically digitized. The Vertical Search Window setting determines the vertical limits of the search window in which data can be digitized.

Contour Line Follow Method – *graph digitizing options*

This option allows you to select method used to follow a contour line, and to select the vertical search window size used for the digitizing process.

Semi-Automatic - Interactive Vertical Limits: This method requires the user to guide the digitizing cursor and associated vertical limits along the data line as the data points are being automatically digitized. The Vertical Search Window setting determines the vertical limits of the search window in which data can be digitized.

Auto Estimating Vertical Limits with Auto Pause: This method automatically moves the cursor and vertical limits while automatically digitizing. Encountering a data gap pauses the software. The Vertical Search Window setting determines the vertical limits of the search window in which data can be digitized.

Raster Scan Direction – *graph digitizing options*

This option determines the starting point and scan direction used in raster scan digitizing.

Lower Left Corner to Upper Right Corner: This method begins digitizing at the lower left corner of the raster scan region, and digitizes

points as the crosshair moves upward and then to the right through each column of pixels in the digitizing region.

Upper Left Corner to Lower Right Corner: This method begins digitizing at the upper left corner of the scan region, and digitizes points as the crosshair moves downward and then to the right through each column of pixels in the digitizing region.

Lower Right Corner to Upper Left Corner: This method begins digitizing at the lower right corner of the scan region, and digitizes points as the crosshair moves upward and then to the left through each column of pixels in the digitizing region.

Upper Right Corner to Lower Left Corner: This method begins digitizing at the upper right corner of the scan region, and digitizes points as the crosshair moves downward and then to the left through each column of pixels in the digitizing region.

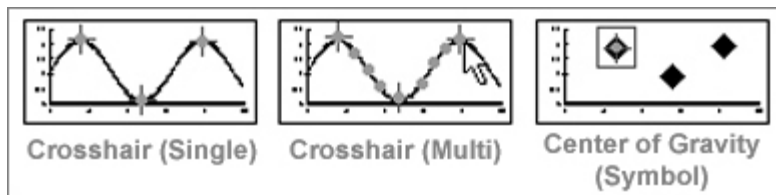
Manual Point Assignment Method – *graph digitizing options*

This option determines the method used to digitize points when using UN-SCAN-IT in Manual Mode (Digitizing Tablet Mode).

Crosshair Position (Single Point Click): This method digitizes one single (x,y) point at the current crosshair position each time the space bar (or right mouse button) is pressed.

Crosshair Position (Multi-Point Drag): This method digitizes multiple (x,y) points as the right mouse button is pressed and the mouse cursor is dragged.

Center of Gravity (Symbol): Pressing the space bar (or right mouse button) digitizes one single (x,y) point which represents the average data pixel location within a raster scan box. The Search Window setting determines the size of the raster search window box to be used for extracting the Center of Gravity data value.



Automatic X Increments (Manual Mode) – *graph digitizing options*

This option determines whether the manual digitizing crosshair will automatically increment in the X direction after each point is digitized in Manual Mode (Digitizing Tablet Mode).

On: This method increments the manual digitizing crosshair one resolution unit in the current direction after each point is manually digitized.

Off: This method causes the manual digitizing crosshair to remain at the current location after each point is manually digitized.

Angle Units – *graph digitizing options*

This option determines the whether a polar graph will be digitized using degree units or radians.

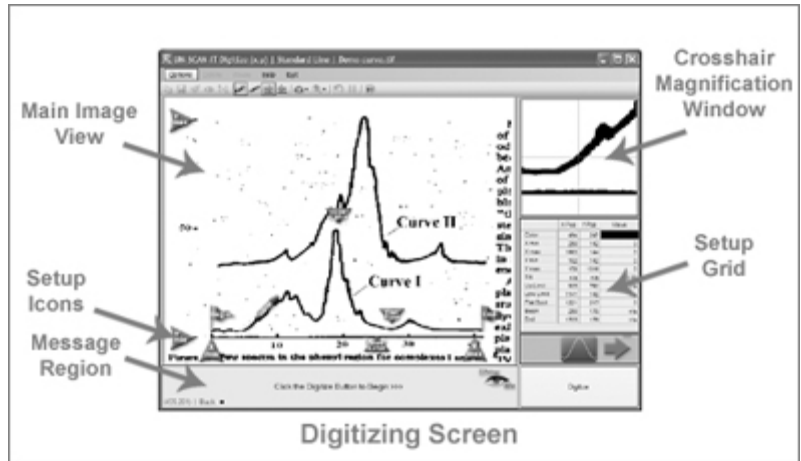
Degrees (0-360): This selection will digitize the chart in standard degrees with a required range of 0 to 360 degrees.

Radians (0-2pi): This selection will digitize the chart in radians with a required range of 0 to 2 pi radians.

5.6 Digitizing Screen

After the setup options have been selected, the main digitizing screen will appear. The main digitizing screen displays the entire image, either

maintaining the aspect ratio or stretched to fit within the resizable main window (depending on the Main Image View selected). A crosshair magnification window in the upper right corner displays a full scanner resolution view of the region surrounding the digitizing crosshair (use this window for fine adjustment of the crosshair position in order to maximize accuracy during the setup procedure). A grid on the right side of the digitizing screen displays the Setup Icon positions and values. A text box at the bottom of the screen provides instructions that guide the user through the digitizing setup process.



The main menu that appears at the top of the digitizing screen contains the following menus:

- Options** Use this menu to adjust digitizing resolutions, change line following direction, change speeds, save the digitized data, etc. These options will be discussed later in this chapter.
- Delete** Select **Delete** to sequentially delete the most recently digitized point(s).
- Pause** The **Pause** menu is only visible during the automatic

digitizing process. The automatic digitizing process can be paused at any point by selecting **Pause** menu option, or by selecting the **Pause** button. When automatic digitizing is paused, the software will temporarily switch to Manual Mode, allowing the graphics crosshair to be repositioned, points added, points deleted, digitizing options changed, etc.

Help Select **Help** to display help topics relating to the setup, options, or general digitizing process. In addition, the customer support contact information is available from the **Help** menu.

Exit Select **Exit** to exit the digitizing process and go to the Main Menu, or to exit the digitizing process and go to the Graphing Screen (only available after points have been digitized).

Options – *digitizing screen*

By selecting the **Options** menu, many of the default and previously selected digitizing options can be modified, and other additional functions performed. The options available will depend on the Graph Digitizing Mode selected earlier in the digitizing process. The **Options** menu may include many of the following options:

Point Assign Method Select this option to change the point assignment method used during automatic digitizing. Details regarding the different point assignment methods can be found in the Graph Digitizing Options portion of this manual.

Manual Point Assign Use this option to change the method used for determining the digitized point location in manual mode. Details regarding the different manual point assignment methods can be found in the Graph Digitizing Options portion of this manual.

- Bar Graph Type** Use this option to change the bar graph type setting used for digitizing. The bar graph type only applies to vertical bar graphs (horizontal bar graphs cannot be digitized with these methods). Details regarding the different bar graph type options can be found in the Graph Digitizing Options portion of this manual.
- Line Follow Side** Use this option to change the current line follow side used for automatic digitizing. Details regarding the different line follow side options can be found in the Graph Digitizing Options portion of this manual.
- Line Follow Direction** Use this option to change the current line follow direction used for digitizing. Details regarding the different line follow direction options can be found in the Graph Digitizing Options portion of this manual.
- Automatic X Increment** Use this option to change the current automatic x increments setting. Using automatic x increments can be useful when manually digitizing a continuous curve. Details regarding the different automatic x increment options can be found in the Graph Digitizing Options portion of this manual.
- Change Side and Dir** Use this option to reverse both the line follow side and line follow direction simultaneously. Details regarding the different line side and line direction options can be found in the Graph Digitizing Options portion of this manual.
- Clear Pause Bars** Use this option to clear the positions of all the current pause bars used for digitizing intersecting curves.

- Set Digitizing Speed** Use this option to change the current digitizing speed used for automatic digitizing. Slowing the digitizing speed can be useful for allowing easier user interaction with the digitizing process. Details regarding the different digitizing speed options can be found in the Graph Digitizing Options portion of this manual.
- Set Main Image View** Use this option to change the current main image view to either Maintain Aspect Ratio or Stretch to Fit. This option can also be used to set the zoom level and increase the size of the image within the viewing area. Note: Automatic Digitizing may be slower while image is zoomed.
- Set Digitizing Resolution** Use this option to change the current digitizing resolution used by the software. The default resolution is 1 scanner unit. The resolution can be set anywhere from 1 to 10 scanner units. The resolution will directly affect the number of data points digitized (e.g. a 10 inch long curve scanned at 300 dpi will produce 3000 data points when digitized at a resolution of 1 scanner unit). Generally the most useful method for adjusting resolution is to digitize the image using a resolution setting of 1. Then later use the **Adjust X Data Spacing** option in the main graphing screen to fit a cubic spline curve to the data and adjust the x spacing.
- Set Eraser/Shifter Size** Use this option to change the size of the UN-SCAN-IT digitized data eraser, and the vertical data shifter. The eraser can be useful for deleting stray points that were erroneously digitized during the automatic digitizing process. The vertical data shifter can be useful for adjusting the vertical position of selected digitized data points.

Set Vert Search Window Use this option to change the size of the vertical search window used by the software for following dashed/dotted graphs or contour plots. This setting determines the vertical limits beyond which the software will not search for data. Properly setting this limit will allow the software to remain on the curve of interest without jumping to another curve or skipping data.

Set Sym Search Window Use this option to change the size of the symbol search window used by the software in manual mode (symbols). This setting determines the square size of the raster region in which the software will average the data pixels to determine a single data value.

Set Data Line Color Use this option to change/set the current pixel color that the software accepts as data. This option is useful for selecting a particular colored data line to digitize among multiple colored curves.

Set Screen Colors Use this option to change the current screen colors and graphic options used by the software. The crosshair color, digitized point color, and digitized point size can be adjusted. Setting these display options can be useful in making the digitizing crosshair and data points more visible on the digitizing screen.

Relocate Setup Icons Use this option to reposition any of the setup icons to new locations. This feature can be useful for redefining the data line color, setting new axis values, etc.

Slide All Axis Setup Icons Use this option to move all the current setup icons and their corresponding location settings in the desired direction. This feature can be especially

useful when used in conjunction with the Save/Load Axis Setup Parameters option. By using these options, multiple graphs with similar axis parameters can be easily digitized by simply saving and loading the axis setup parameters, and then sliding the axis setup icons to account for shifts that may have occurred during the scanning process.

- Current Settings & Info** Use this option to display the current digitizing and setup options that have been selected, as well as some general information regarding the current image.
- Copy Screen Image** Use this option to Copy the current digitizing Screen Image to the Clipboard. The screen image can then be Pasted into another program (word processor, graphics, etc.).
- Adjust X Data Spacing** The digitizing process converts scanner pixel units into user defined scaled units. The resulting X data spacing may appear arbitrary as a result of this conversion. However, the X data spacing can be adjusted by fitting the digitized data points using a cubic spline or linear fit. To Adjust X Data Spacing, go to the Graphing Screen.
- Save Current (x,y) Data** Use this option to save the current digitized (x,y) data to a standard data file (or the Windows clipboard). The saved data file can then be read into other programs, such as spreadsheet, data analysis, or graphics software.
- Clear Current (x,y) Data** Use this option to clear the current digitized (x,y) data from memory. This option is useful for clearing data that has been saved, and then digitizing additional data on the same image.

Clearing data can also be useful for deleting erroneous data before returning to the digitizing process.

Save Axis Setup Param Use this option to save the current axis setup parameters (Xmin, Xmax, Begin, End, etc.). This option can be very useful for saving and retrieving the setup icon positions and values in order to digitize the current image or another similar image at a later time, without having to re-define all of the setup icon positions and values.

Load Axis Setup Param Use this option to load previously saved axis setup parameters (Xmin, Xmax, Begin, End, etc.). This option can be very useful for retrieving previously saved setup icon positions and values in order to re-digitize a previous image or digitize another similar image, without having to re-define all of the setup icon positions and values.

5.7 Positioning the Setup Icons

This section will assist you in positioning the setup icons at their appropriate locations on the graphical image. All of the required Setup Icons must be dragged to their corresponding graphical locations before digitizing can begin. The pending required Setup Icons are indicated with a gray arrow beside the icon, and can be found along the bottom edge of the main digitizing window. The accuracy of the digitized data will depend directly upon the precision with which the setup icons are located on the image.

Icon and Crosshair Movement – *positioning the setup icons*

The setup icons can be dragged to their proper locations by clicking and holding the left mouse button while dragging the setup icon to the desired

location (the hot spot on the setup icon will be shown with a digitizing crosshair). Fine icon movements can be achieved by pressing the keyboard arrow (or Ctrl+arrow) keys while the left mouse button remains depressed on the setup icon. Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment.

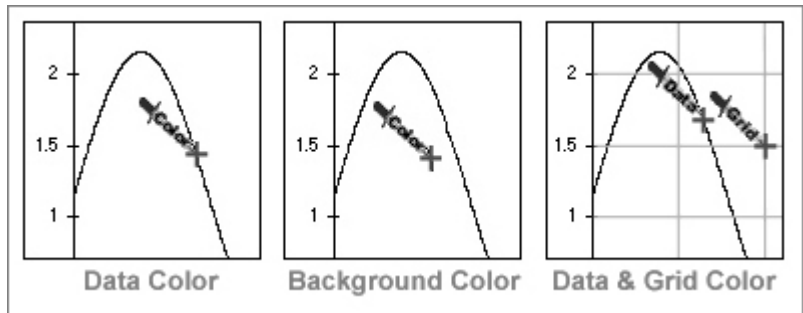
Data Color – positioning the setup icons

If **Black and White, Grayscale, or Color** was the color type selected, then move the Color Icon so that it is exactly over the data line you wish to digitize. Use the crosshair magnification window in the upper right corner of the digitizing screen for precise alignment. The color selected will be displayed in the grid at the right side of the screen. This step identifies the data line color that UN-SCAN-IT will accept as data.

If **Digitize All Colors Except Background** was the color type selected, then move the Color Icon so that it is exactly over the background color that UN-SCAN-IT will ignore and not accept as data. Use the crosshair magnification window in the upper right corner of the digitizing screen for precise alignment. The background color selected will be displayed in the grid at the right side of the screen. This step identifies the background color that UN-SCAN-IT will ignore and not accept as data.

Grid Line Color - If the Line Intensity (Grayscale) grid line filter has been selected, the Grid Line Color must be also identified. Move the Grid Icon so that it is exactly over a major grid line. Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. The grid line color selected will be displayed in the grid at the right side of the screen. This identifies the grid line intensity.

Note: Incorrectly identifying the data (or background) color will result in errors during the digitizing process.



Locating Axis Scaling Points – *positioning the setup icons*

Cartesian (x,y) Coordinates

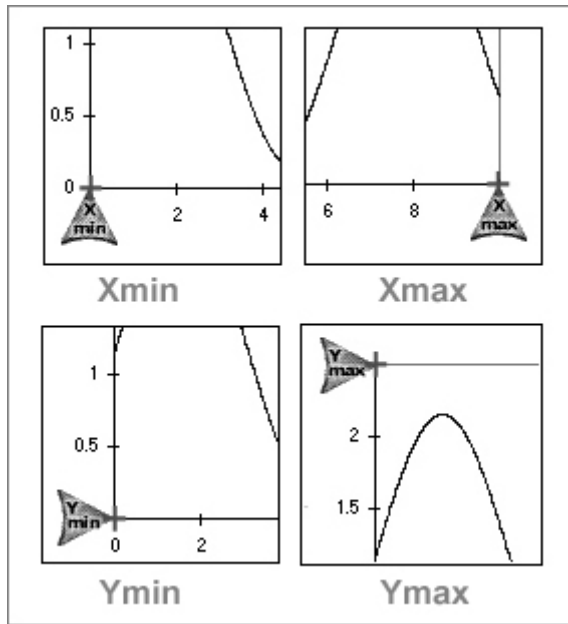
Xmin: Move the X min Icon so that it is exactly over the lowest (leftmost) X axis scaling mark. The X min Icon should be located on a scaling mark where the X value is known (not on the data line where the X value is not known). Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data. The X min Icon should generally be placed over the center of the scaling mark for best precision and accuracy.

Xmax: Move the X max Icon so that it is exactly over the highest (rightmost) X axis scaling mark. The X max Icon should be located on a scaling mark where the X value is known (not on the data line where the X value is not known). Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data. The X max Icon should generally be placed over the center of the scaling mark for best precision and accuracy.

Ymin: Move the Y min Icon so that it is exactly over the lowest (bottom) Y axis scaling mark. The Y min Icon should be located on a scaling mark where the Y value is known (not on the data line where the Y value is not known). Use the crosshair magnification in the upper right corner of the

digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data. The Y min Icon should generally be placed over the center of the scaling mark for best precision and accuracy.

Ymax: Move the Y max Icon so that it is exactly over the highest (top) Y axis scaling mark. The Y max Icon should be located on a scaling mark where the Y value is known (not on the data line where the Y value is not known). Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data. The Y max Icon should generally be placed over the center of the scaling mark for best precision and accuracy."

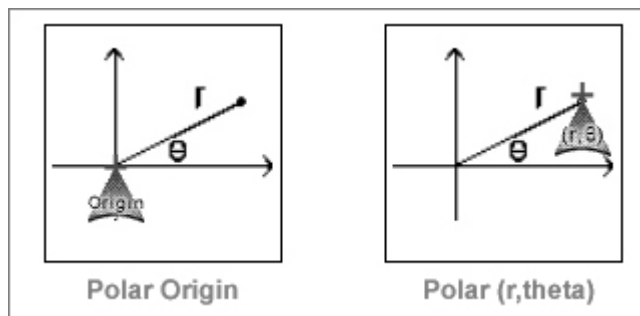


Note: It is important to be consistent in locating the positions of the tick marks (e.g. always use the center of the tick mark when defining the axes points). Careful attention to defining the axes scaling points is critical for obtaining accurate digitizing results.

Polar (r,theta) Coordinates

Origin: Move the Origin Icon so that it is exactly over the origin ($r=0$, $\theta=0$) of the polar coordinate system. Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data.

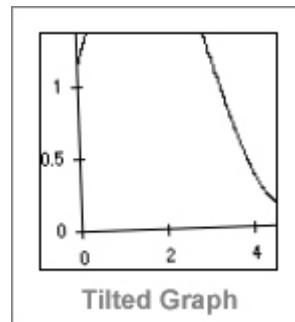
(r, theta): Move the (r, theta) Icon so that it is exactly over an axis point or a data point where the (r, theta) value is known. Use the crosshair magnification in the upper right corner of the digitizing screen for precise alignment. Incorrectly identifying the scaling marks will result in errors in the digitized data. Scaling points with horizontal and vertical components of the (r, theta) location will be required for proper scaling.



Numerical Values - After defining each axis location, UN-SCAN-IT will prompt you to enter the numerical value corresponding to that particular scaling mark.



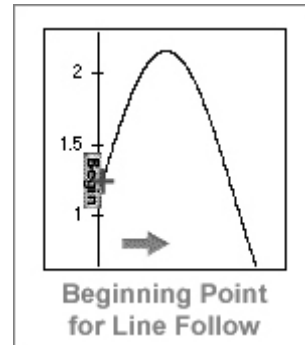
Tilt Correction: Based upon the difference in the vertical pixel locations and the difference in the horizontal pixel locations at the Xmin and Xmax setup icons, UN-SCAN-IT will determine if the graph is tilted. If the graph is tilted, UN-SCAN-IT will determine the tilt angle and allow the user to choose to correct the data values. Although the software will correct the digitized data for graphs that are slightly tilted, graphs that are tilted more than 5 degrees may cause errors in the digitized data, and should be scanned again (or rotated to the proper alignment using your scanner or image processing software). Although UN-SCAN-IT will correct for tilted graphs, graphs that have no tilt or a very small tilt will product the most accurate and symmetric digitized data. The axis lines must be orthogonal (i.e. at right angles to each other) to obtain accurate results.



Locating Beginning Point – *positioning the setup icons*

Automatic Line Follow Modes

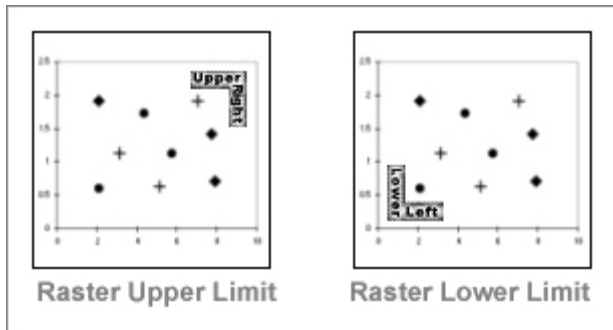
Begin: Move the Begin Icon to the location where you wish the digitizing process to begin. If the current Line Follow Direction is >>> Left to Right >>>, the Begin Icon should be located at the leftmost point to digitize. If the current Line Follow Direction is <<< Right to Left <<<, the Begin Icon should be located at rightmost point to digitize.



Raster Scan Modes

Raster Upper Limit: Move the Upper Right Icon to the upper right corner of the area you wish to raster scan. The Upper Right Icon should be vertically located slightly ABOVE the highest point to be raster scanned, and horizontally located slightly to the RIGHT of the rightmost point to be raster scanned.

Raster Lower Limit: Move the Lower Left Icon to the lower left corner of the area you wish to raster scan. The Lower Left Icon should be vertically located slightly BELOW the lowest point to be raster scanned, and horizontally located slightly to the LEFT of the leftmost point to be raster scanned.



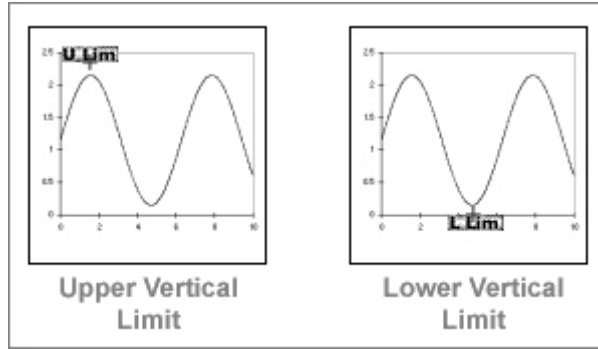
Defining Vertical Limits – positioning the setup icons

Defining the vertical limits prevents the system from accepting or searching for data outside the specified vertical digitizing region. This feature speeds the digitizing process and reduces the possibility of finding extraneous data or following axes lines.

Automatic Line Follow Modes

Upper Vertical Limit: Move the Upper Limit Icon to a vertical location slightly ABOVE the highest vertical point on the data curve. This step sets the upper vertical limit beyond which UN-SCAN-IT will not search. Setting the Upper Limit Icon too high may allow the software to erroneously follow another data line or the upper axis line. Setting the Upper Limit Icon too low will cause the software to erroneously ignore the data line above that limit.

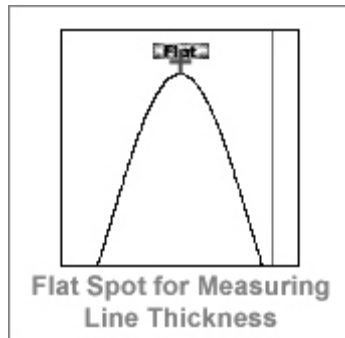
Lower Vertical Limit: Move the Lower Limit Icon to a vertical location slightly BELOW the lowest vertical point on the data curve. This step sets the lower vertical limit beyond which UN-SCAN-IT will not search. Setting the Lower Limit Icon too low may allow the software to erroneously follow another data line or the lower axis line. Setting the Lower Limit Icon too high will cause the software to erroneously ignore the data line below that limit.



Flat Spot / Line Thickness – *positioning the setup icons*

Automatic Line Follow Modes

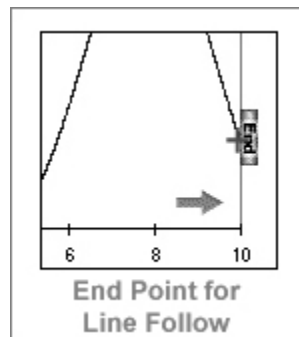
Flat Spot: Move the Flat Spot Icon to a vertical location slightly ABOVE a relatively flat portion of the data line. This step is used to measure the flat line thickness of the data curve, in order to best estimate the location of the middle of the data line during digitizing. The Flat Spot Icon should be located above the data line that matches the selected Data Line Color. Locating the Flat Spot Icon over a steep portion of the data line will cause the measured line thickness to be too large and will result in a vertical shift error in the digitized data. If there is no flat portion of the data line available, the Flat Spot icon can be placed above a flat portion of any horizontal line of similar thickness and color as the data line. To disable or re-enable the line thickness correction, press the Esc key while positioning the Flat Spot Icon.



Locating Ending Point – *positioning the setup icons*

Automatic Line Follow Modes

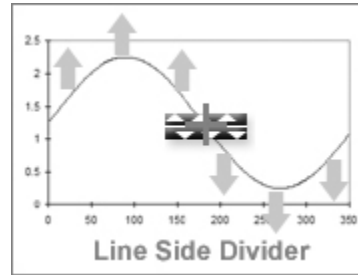
End: Move the End Icon to the location where you wish the digitizing process to end. If the current Line Follow Direction is >>> Left to Right >>>, the End Icon should be located at the rightmost point to digitize. If the current Line Follow Direction is <<< Right to Left <<<, the End Icon should be located on leftmost point to digitize.



Variable Surface – positioning the setup icons

Automatic Line Follow Modes

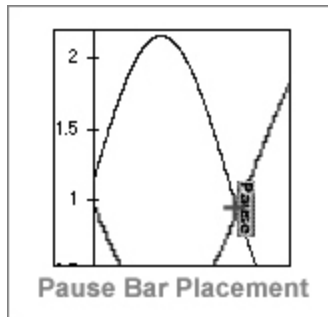
Variable Surface: If Variable Surface of Line was selected, then position the Line Side Divider Icon (red and blue icon with arrows) where the software should automatically switch Line Follow Sides. The software will follow the Upper Surface of the line when it is above this icon, and the Lower Surface of the line when it is below this icon.



Pause Bars – positioning the setup icons

Intersecting Line Follow Mode

Pause Bars: If Manual Pause Bars was selected, then move the Pause Icon so that it is exactly over the point on the data line where the software should pause during the automatic line following process. A maximum of 10 pause bars can be inserted. Automatic digitizing can also be paused (and then resumed) at any time by selecting the Pause button during automatic digitizing.



5.8 Digitizing Modes

The process in which the image is digitized depends upon which Graph Digitizing Mode was selected during the digitizing setup process.

Automatic Line Follow Modes - *digitizing modes*

After all of the setup icons have been positioned and digitizing has begun, a graphics crosshair will appear on the image. As the crosshair follows the data line, the current number of data points digitized (**N:**), the x value of the most recent digitized point (**X:**), and the y value of the most recent digitized point (**Y:**) will be displayed at the bottom of the screen. These values will also be stored and displayed in the data spreadsheet at the right side of the digitizing screen.

The crosshair will automatically follow along the data line being digitized, and will move in the current line follow direction as each digitized data point is assigned. The digitized data points will appear graphically as colored dots along the data line, and these dots can be used to gauge the accuracy of the digitized data. The color and size of the dots can be changed in the **Set Screen Colors** portion of the **Options** menu.

The digitizing process can be paused at any point by selecting the **Pause** button (or by pressing **Enter**). The software will temporarily switch to Manual Mode. In Manual Mode the graphics crosshair to be repositioned, points added, points deleted, digitizing options changed, etc. Select **Continue**

to resume automatic line follow digitizing.

If the crosshair is moving too quickly along the data line, the digitizing process can be slowed by selecting **Set Digitizing Speed** in the **Options** menu

The digitizing process can be discontinued at any time by selecting **Exit**.

Upon completion of the digitizing process, a window will appear that will prompt you regarding the digitized data.

Accept the Data Points and Return to Digitizing Screen: Choose this option if the digitized data points appeared acceptable and you wish to save, view, erase, shift, or digitize additional data points on the graph.

Accept the Data Points and Go To Graphing Screen: Choose this option if the digitized data points appeared acceptable and you wish to go directly to the Graphing Screen where you can edit, sort, smooth, integrate areas, etc. (see the Graphing / Modifying (x,y) Data chapter for details).

Do not Accept the Data Points and Return to Digitizing Screen: Choose this option if the digitized data points are not acceptable, and you wish to return to the Digitizing Screen and adjust the setup icons, change digitizing options, or exit the digitizing process.

Raster Scan Modes - *digitizing modes*

After all of the setup icons have been positioned and digitizing has begun, a graphics crosshair will appear on the image. As the crosshair moves through the region being raster scanned, the current number of data points digitized (**N:**), the x value of the most recent digitized point (**X:**), and the y value of the most recent digitized point (**Y:**) will be displayed at the bottom of the screen. These values will also be stored and displayed in the data spreadsheet at the right side of the digitizing screen.

The digitized data points will appear graphically as colored dots overlapping each data point. The color and size of the dots can be changed in the **Set Screen Colors** portion of the **Options** menu.

The digitizing process can be paused at any point by selecting **Pause** (or by pressing **Enter**). The software will temporarily switch to Manual Mode. In Manual Mode the graphics crosshair to be repositioned, points added, points deleted, digitizing options changed, etc. Select **Continue** to resume raster scan digitizing.

If the crosshair is moving too quickly throughout the data, the digitizing process can be slowed by selecting **Set Digitizing Speed** in the **Options** menu

The digitizing process can be discontinued at any time by selecting **Exit**.

Upon completion of the digitizing process, a window will appear that will prompt you regarding the digitized data.

Accept the Data Points and Return to Digitizing Screen: Choose this option if the digitized data points appeared acceptable and you wish to save, view, erase, shift, or digitize additional data points on the graph.

Accept the Data Points and Go To Graphing Screen: Choose this option if the digitized data points appeared acceptable and you wish to go to the Graphing Screen where you can edit, sort, smooth, integrate areas, etc. (see the Graphing / Modifying (x,y) Data chapter for details).

Do not Accept the Data Points and Return to Digitizing Screen: Choose this option if the digitized data points are not acceptable, and you wish to return to the Digitizing Screen and adjust the setup icons, change digitizing options, or exit the digitizing process.

Manual Modes - *digitizing modes*

After all of the setup icons have been positioned and digitizing has begun, a graphics crosshair will appear on the image. The current number of data points digitized (**N:**), the current x position of the graphics crosshair (**X:**), and the current y position of the graphics crosshair (**Y:**) will be displayed at the bottom of the screen (if digitizing in polar coordinates, the r and theta coordinates will be displayed). These values will also be stored and displayed

in the data spreadsheet at the right side of the digitizing screen.

The crosshair can be positioned using the left mouse button, the keyboard arrow keys for fine movement, or the **Ctrl** + arrow keys for coarse movements. As each point is digitized, a colored dot will appear at that position. The color and size of the dots can be changed in the **Set Screen Colors** portion of the **Options** menu.

The digitizing process can be discontinued at any time by selecting **Exit**.

Crosshair Position Mode - Press the **Space Bar** (or right mouse button) to digitize the point currently located at the graphics crosshair. Use the crosshair magnification window in upper right corner of the screen for precise crosshair alignment. If **Automatic X Increments** were selected in the **Options** menu, the graphics crosshair will increment automatically along the x-axis after each point is digitized. To delete the most recently digitized point(s) select **Delete**.

Center of Gravity (Symbol) Mode - Press the **Space Bar** (or right mouse button) to digitize the point or symbol within the raster scan region of the crosshair (this raster region is indicated by a box around the center of the crosshair). Use the crosshair magnification window in upper right corner of the screen for precise crosshair alignment. The software will raster scan the search region, find the average location of the digitized pixels in that region, and assign a single digitized value based upon that average. To delete the most recently digitized point(s) select **Delete**.

5.9 Erasing Digitized Data Points

Stray marks, other data lines, axes lines, symbols, etc. may occasionally be incorrectly identified as data points during the digitizing process. A data eraser can be activated by selecting the **Erase Data** button near the bottom of the digitizing screen. Position the data eraser box over the data points you wish to delete, and press the left mouse button to delete the underlying data points from memory and the digitizing screen. The data eraser size can be modified by selecting **Set Data Eraser Size** in the **Options** menu. Press **Esc** to exit the data erasing mode, and return to the digitizing mode.

5.10 Shifting Data Vertically

It may be useful to adjust the vertical positions of selected digitized data points after they have been digitized. The Vertical Data Shifter can be activated by selecting the data shifter button from the digitizing toolbar. Position the Shift Data box over the points to shift. Pressing the left mouse button will shift the points and their values down. Pressing the right mouse button will shift the points and their values up. The data shifter size can be modified by selecting **Set Data Shifter Size** in the **Options** menu. Press Esc to exit the shift data mode, and return to the digitizing mode.

5.11 Adjusting the X Spacing of the Data

When digitizing images the inherent image resolution is usually sufficient to produce excellent digitizing results. However, you may wish to increase, decrease or modify the X Data Spacing between the data points to a user specified value (this will allow multiple curves to have the same x-spacing and be graphed simultaneously using other graphing software). This feature can also the user to define a set number of digitized data points with user defined spacing. To modify the x spacing of the digitized data, you may wish to use the **Adjust X Data Spacing** feature available in UN-SCAN-IT. To access this feature, go to the Graphing Screen. For details regarding the use of the **Adjust X Data Spacing** feature, refer to the Graphing / Modifying (x,y) Data chapter.

5.12 Exporting the Digitized Data to Other Software

The primary purpose of the UN-SCAN-IT software is to extract the underlying (x,y) values from graphical images. Once the digitizing process is complete, the extracted data can be exported to other software by either saving the (x,y) data as an ASCII Text data file, or copying the (x,y) data directly to the Windows Clipboard and pasting the data into the desired software. These **File** options are discussed later in this manual.

Chapter 6

GRAPHING / MODIFYING (X,Y) DATA

6.1 Overview

This chapter will guide you through the different **Graphing** options present in the UN-SCAN-IT software. The graphing options allow you to graphically view, edit, and analyze the digitized data. Additionally, the (x,y) data can be exported to other graphing or spreadsheet software for analysis.

Many of the UN-SCAN-IT graphing menu options can also be accessed from the toolbar located below the graphing menus. The Help menus may be used to provide helpful information regarding the graphing options and buttons.

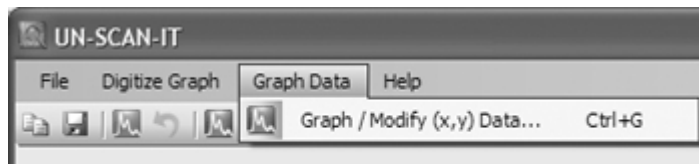
6.2 Main Menu

To enter the **Graph** portion of the UN-SCAN-IT program from the main menu select:

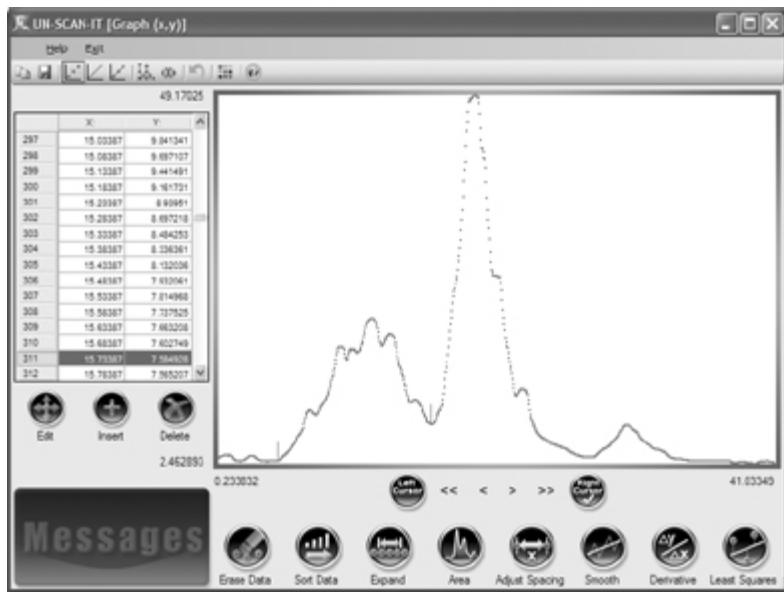
Graph Data

Graph / Modify (x,y) Data - main menu

Select **Graph / Modify (x,y) Data...** to graphically view and modify the (x,y) digitized data.



Graph Data Menu



Graphing Screen

6.3 Cursor Movement

The UN-SCAN-IT Graphics Screen is equipped with two interactive cursors (small vertical lines). These left and right cursors can be used for data identification, modification, and analysis.

The Left Cursor or Right Cursor can be activated by clicking the buttons at the bottom of the graph screen. The active cursor will blink, and have a checkmark displayed in the corresponding button at the bottom center of the graph.

The active cursor can be moved by clicking the mouse at the desired horizontal position on the graph, clicking the arrow buttons at the bottom of the graph, using the keyboard arrow keys (**Ctrl** + arrow keys for larger movements), or by selecting the desired data point in the spreadsheet on the left side of the screen.

The x and y values of the data point at the active cursor are highlighted in the spreadsheet on the left side of the screen.

If you have any difficulty using or moving the cursors, you may wish to click the **Sort** button to sort the data into ascending or descending array order. The Left Cursor and Right Cursors cannot cross each other (in array order), so data arrays that are not sorted may prevent proper movement of the graphic cursors.

6.4 Graph Options

After the graph is displayed on screen, an **Options** menu will be available that contains useful graphical options and features:

Undo Delete Select **Undo Most Recent Point Delete** to restore the most recent data point that has been deleted.

Draw Points Select **Draw Points** to display the (x,y) data points as dots on the screen. The data point size can be set using the Set Graph Colors option.

Draw Lines Select **Draw Lines** to connect the (x,y) data points with straight lines. If the data are not sorted, the lines may appear to be connected in a haphazard manner, and you may wish to sort the data. The data line size can be set using the Set Graph Colors option.

Points & Lines Select **Draw Points and Lines** to display the (xy) data points as dots connected with straight lines. If the data are not sorted, the lines may appear to be connected in a haphazard manner, and you may wish to sort the data. The data point and line size can be set using the Set Graph Colors option.

X Direction Select **X Direction... Low to High** to scale the graph with

the lowest x values on the left and highest x values on the right. Select **X Direction... High to Low** to scale the graph with the highest x values on the left and lowest x values on the right.

Y Direction Select **Y Direction... Low to High** to scale the graph with the lowest y values on the bottom and highest y values on the top. Select **Y Direction... High to Low** to scale the graph with the highest y values on the bottom and lowest y values on the top.

Set Scale Select **Set Scale...** to manually choose the x and y scales used to display the graph. Full Scale is defined such that all of the data points will appear on the graph. Linear, log, and semi-log scales can be selected.

X Data Spacing Select **Adjust X Data Spacing...** to adjust the x data spacing by fitting the data with either a cubic spline or linear fit. A window will appear with several options. Enter the data range to be adjusted and the desired x increments. Xmin cannot be less than the lowest x data point, and Xmax cannot be greater than the highest x data point. The X Increment is the desired spacing (in user units) between adjusted x points. The New # of Points represents the number of data points after the adjustment is performed. You may select a Cubic Spline fit or Linear fit for the digitized data points. The original and adjusted data will be displayed on screen, and you will be prompted to replace the original data with the adjusted data or retain the original data. This feature is useful for aligning x spacing in order to graph multiple curves on the same scale using other graphing software or to set x data points to exact user specified values. This feature can also be used allow to user to define a set number of digitized data points.

Graph Colors Select **Set Graph Colors...** to change the background color, data point color, data line color, cursor color, highlight point color, highlight line color, data point size,

and data line size.

- Set Eraser Size** Select **Set Data Eraser and Data Shifter Size...** to change the size of the graphical data eraser . This eraser can be useful for deleting stray points that were obtained during the automatic digitizing process.
- Edit/Ins Mode** Select **Edit/Insert Mode... Keyboard** to use the keyboard to edit or insert data points on the graph when the **Edit** or **Insert** button has been selected. Select **Edit/Insert Mode... Mouse** to use the mouse for point and click editing and insertion of data points when the **Edit** or **Insert** button has been selected.
- Temporary File** Select **Temporary File... Add Current Data Point** to add the data point at the active cursor (or Area value if area is highlighted) to the temporary file. Select **Temporary File... Clear Temporary File** to erase all the data values in the temporary file. Select **Temporary File... Copy Temporary Data to Clipboard** to copy all the data in the temporary file to the clipboard and allow the data to be pasted into another program (spreadsheet, word processor, etc.). These options are useful for extracting just a few selected data points or area values from the graph.
- Screen Image** Select **Copy Screen Image to Clipboard...** to Copy the current digitizing Screen Image to the Clipboard. The screen image can then be Pasted into another program (word processor, graphics, etc.).
- Save (x,y) Data** Select **Save Data...** to save the (x,y) data to a file. The current (x,y) data can be saved to a standard data file, or copied to the Windows clipboard. The data can then be read into other programs, such as spreadsheet, data analysis, or graphics software.
- Load (x,y) Data** Select **Load (x,y) Data...** to load a previously digitized (x,y) data file, or to load a standard (x,y) ASCII Text data

file. The standard Windows dialog box will appear. Loading a file clears all digitized data presently in memory. The software can load data saved by UN-SCAN-IT; or standard comma or tab delimited (x,y) ASCII Text data saved by other programs.

6.5 Graph Buttons

After the graph is displayed on screen, a series of graph buttons will be displayed below the data spreadsheet and at the bottom of the graphing screen

Edit Point - graph buttons

The data point at the active cursor can be edited by selecting the **Edit** button. In Keyboard Edit Mode, the current x and y values at the active cursor will be displayed in the edit box. Edit these values to change the value of the selected point. In Mouse Edit Mode, simply click on the graph where you wish to locate the edited point.

Insert Point - graph buttons

A data point can be added to the data file and displayed on the screen by selecting the **Insert** button. In Keyboard Insert Mode, the current x and y values at the active cursor will be displayed in the insert box. Enter the x and y values of the new data point. In Mouse Insert Mode, simply click on the graph where you wish to locate the new point.

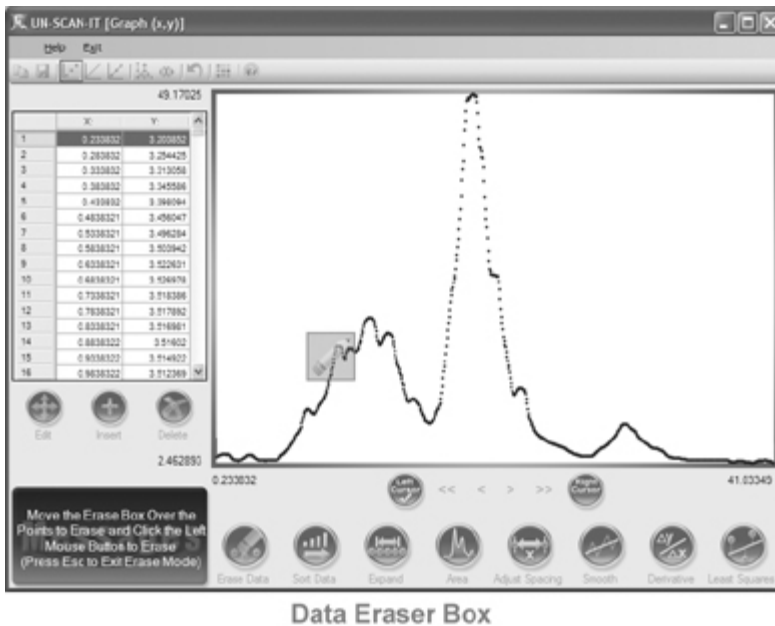
Delete Point - graph buttons

The data point at the active cursor can be deleted from the data file and erased from the graphing screen by selecting the **Delete** button. Select **Undo Most Recent Point Delete** from the **Options** menu to restore the most recently deleted data point.

Erase Data - graph buttons

The data eraser can be activated by selecting the **Erase Data** button. Position the data eraser box over the data points you wish to delete, and press the left mouse button to delete the underlying data points from memory and the graphing screen. The data eraser size can be modified by selecting **Set Data Eraser Size** in the **Options** menu. Press **Esc** to exit the data erasing mode,

and return to the regular graphing mode.



Sort Data - graph buttons

The entire (x,y) data array can be sorted into ascending or descending x order by selecting the **Sort** button. This option should be used when data have been added to the digitized file or some of the data points are not in increasing (or decreasing) x array order. Some of the cursor and graphing options may not work properly if the data are not properly sorted.

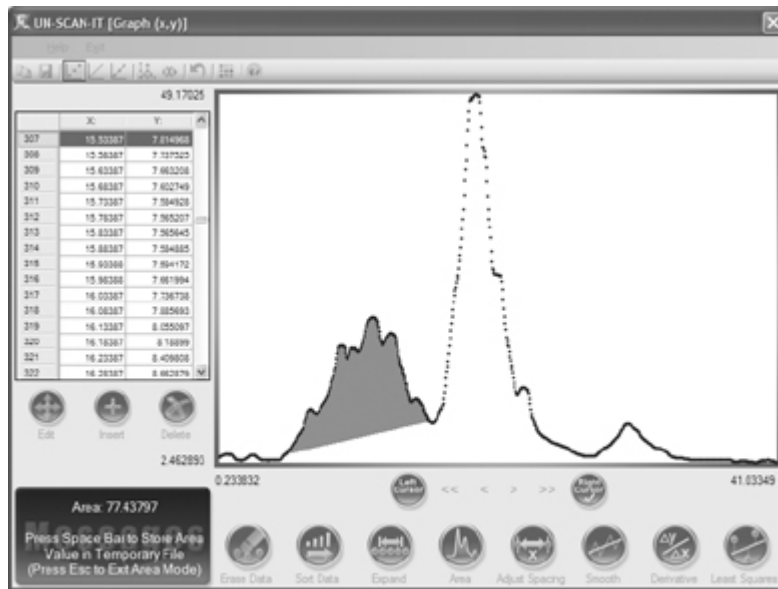
Expand - graph buttons

The region between the cursors can be expanded to fill the graphing screen by selecting the **Expand** button. To return to full scale, right click the **Expand** button (or use the **Set Scale** feature in the **Options** menu).

Area - graph buttons

The area under the curve between the graphics cursors can be integrated by

selecting the **Area** button. The UN-SCAN-IT software uses the trapezoidal rule to determine the area. The area (x units multiplied by y units) will be displayed in the upper right message box. The background selection for the area calculation is a straight line between the cursors, and can be modified by Inserting or Deleting data points, and locating the cursor on the new data point to calculate a new background. Press **Esc** to exit the area mode, and return to the regular graphing mode.



Area Integrated Between Cursors

Adjust X Data Spacing - graph buttons

The x data spacing of the data points can be adjusted by selecting the **Adjust Spacing** button.. A window will appear with several options. Enter the data range to be adjusted and the desired x increments. Xmin cannot be less than the lowest x data point, and Xmax cannot be greater than the highest x data point. The X Increment is the desired spacing (in user units) between adjusted x points. The New # of Points represents the number of data points after the adjustment is performed. You may select a Cubic Spline fit or Linear fit for

the digitized data points. The original and adjusted data will be displayed on screen, and you will be prompted to replace the original data with the adjusted data or retain the original data.

This feature is useful for aligning x spacing in order to graph multiple curves on the same scale using other graphing software or to set x data points to exact user specified values. This feature can also allow the user to define a set number of digitized data points

Smooth - graph buttons

The entire (x,y) data set can be smoothed by selecting the **Smooth** button. The program will sort the data and then prompt you to select the number of points in the smoothing function, and the type of smooth to be performed. The n-point smooth is a standard boxcar averaging smooth, while the weighted smooth statistically prioritizes each data point in order to best retain the original peak height and shape. The original and smoothed data will be displayed on screen, and you will be prompted to replace the original data with the smoothed data., or retain the original data.

Derivative - graph buttons

A derivative of the entire (x,y) data set can be obtained by selecting the **Derivative** button. The program will sort the data and then prompt you to select the number of points in the smoothed derivative operation, and to select the derivative type. The standard 1st derivative (dy/dx) is a standard derivative (with no smoothing), while the weighted derivative options statistically weights and smoothes the derivative data as it is processed. The original and derivative data will be displayed on screen, and you will be prompted to replace the original data with the derivative data, or retain the original data.

Least Squares - graph buttons

A least squares polynomial can be fit to the data by selecting the **Least Squares** button. You will be prompted to enter the order of fit for the least squares equation.

Select **Average Value** to obtain an average Y value for the data.
($y = a$)

Select **1st Order Polynomial** to obtain a linear line fit of the data.
($y = a + bx$)

Select **2nd Order Polynomial** to obtain a second order fit of the data.
($y = a + bx + cx^2$)

The original data and least squares fit will be displayed on screen, and the least squares constants and standard deviation will be displayed in the message box.

6.6 Help

Select **Help** to display help topics relating to the graphing options and buttons. In addition, the customer support contact information is available from the **Help** menu

6.7 Exit

Select **Exit Graph** to exit the graphing screen and return to the Main Menu, or to exit the graphing screen and return directly to the Digitizing Screen (only available if the graphing screen was accessed from the digitizing screen).

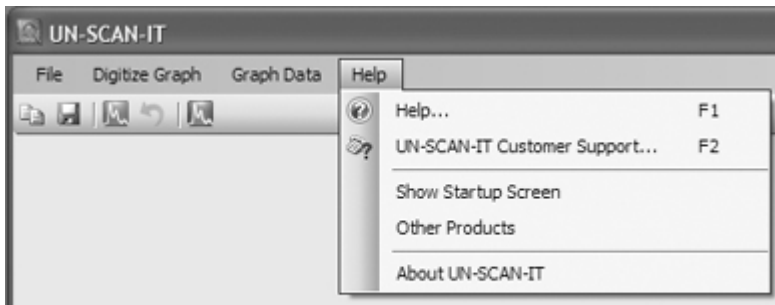
Chapter 7

UN-SCAN-IT HELP

7.1 Help Menu

To enter the **Help** portion of the UN-SCAN-IT program from the main menu select:

Help



Help Menu

7.2 Help

Context sensitive help is available throughout the digitizing and graphing screens. If you have further questions or need assistance, please contact customer support.

7.3 Customer Support

**Silk Scientific, Inc.
P.O. Box 533 Orem, Utah 84059 USA
Tel: 1-801-377-6978 Fax: 1-801-228-2448
E-Mail: info@silkscientific.com**

7.4 Show Startup Screen

Selecting this menu option will display the Startup Screen, and allow you to directly choose to Digitize a Graph, Load (x,y) Data File, or go to Main Menu whenever the program starts.

7.5 Other Products

Selecting this menu option will display information about Silk Scientific's other products. We do currently have Macintosh versions of our products, as well as the UN-SCAN-IT gel software that digitizes electrophoresis gels and TLC plates. Please visit www.silkscientific.com for details.

7.6 About UN-SCAN-IT

Selecting this menu option will display the current UN-SCAN-IT version number, Serial Number, and license holder.

Appendix A

SCANNING AND MODIFYING THE IMAGE

Overview

The UN-SCAN-IT software imports standard image files from scanners, digital cameras, the internet, etc. These images should be obtained and modified using the hardware and software provided with these devices, or by using third party imaging software. The final image should be 'right side up' with the x-axis in the horizontal direction. The image should be saved in a standard image format (tif, jpg, png, bmp, gif, etc.).

In addition, we have provided the **Modify Image** feature for your convenience. This feature provides some basic image modifying capabilities. To Modify an image, select **Scan/Modify Image...** from the UN-SCAN-IT main **File** menu.

File - scan/modify image

- | | |
|-------------------------------|---|
| Open | Select Open... to open an existing image file. |
| Save | Select Save... to save the current image. |
| Restore Original Image | Select Restore Original Image to return the image to its unmodified state. |

Modify - scan/modify image

- | | |
|--------------------|--|
| Rotate | Select Rotate... to rotate the image to a new value. |
| Color Depth | Select Color Depth... to adjust the bcolor properties and bit-depth of the image. |

Brightness

Select **Brightness...** to adjust the brightness of the image.

Invert

Select **Invert** to invert the color of all pixels in the image.

Appendix B

TROUBLESHOOTING FAQs

Overview

This appendix provides some possible solutions to questions that may be encountered while using the UN-SCAN-IT software to digitize (x,y) graphs. Please do not struggle with any technical issues that you may have regarding the use of this software, as we can often answer your question and solve your problems based upon our experience. Please note that the customer support information listed below can also be displayed from within the software by accessing the main **Help** menu.

Customer Support:

Silk Scientific
P.O. Box 533 Orem, Utah 84059 USA
Tel: 1-801-377-6978 Fax: 1-801-228-2448
E-Mail: info@silksscientific.com

Question: Is there a way to get the image to load and digitize faster?

Answer(s):

- Try scanning and saving the image at a lower dpi (dots per inch) resolution from within your scanning software.
- If you are loading the image file from a disk, copy the file to the hard drive, and load the image file from the hard drive.
- Move the software onto a faster computer with more memory.

Question: What could prevent UN-SCAN-IT from reading the image?

Answer(s):

- Make sure you are loading the image file from the **Digitize** menu and not the **File/Load** menu.
- Make sure the file was saved in a standard scanner format accepted by UN-SCAN-IT (e.g. .jpg, .tif, .bmp, etc.).
- Try reading the image file on a different computer to make sure that it is not a hardware problem unique to your computer.

Question: Does UN-SCAN-IT digitize PDF files?

Answer:

- UN-SCAN-IT does not currently accept PDF files. PDF files often contain multiple pages, imbedded text, and variable dpi settings, which can present difficulties in extracting accurate and useful digitized data. PDF files should be converted to a standard image format (tif, jpg, bmp, png, etc) before loading into UN-SCAN-IT.

Question: Why does the image appear stretched or distorted in the Main Window?

Answer:

- If the Stretch to Fit option was selected, the entire image is scaled to fit within the main digitizing window. Any stretching of the image is to allow the entire image to fit in the within the main window (this apparent stretching will not affect the digitized data). If you would like to reduce the stretching in the main window, you can either resize the UN-SCAN-IT main window to dimensions more similar to the original image, or select the Maintain Aspect Ratio option to preserve the original image width to height ratio when displaying the image in the main digitizing windows.

Question: What if the grid line is digitized rather than the data line?

Answer(s):

- During the scanning process try adjusting the contrast control on your scanner to ignore the grid lines but pick up the data line.
- Use one of the grid line filters available within the digitizing setup menu.
- Make a photocopy of the original graph, using the sensitivity adjustment of the photocopy machine to reduce the intensity of the grid lines.
- Erase the grid lines on one side of the data line with your scanning software or other computer paintbrush program, and re-save the image. Then use the Surface of Line point assignment to follow only the surface of the data line.
- Digitize the graph in Manual Mode so that you can guide the crosshair along the data line, and ignore the grid lines.

Question: Why would UN-SCAN-IT not digitize data points near the axes lines?

Answer(s):

- Ensure that the vertical limits were properly and accurately defined at the beginning of the digitizing process. The defined values should extend beyond the lowest and highest data points being digitized.
- Make sure the line trace does not approach too closely to the axes, and if it does, define the axes slightly further away from the line trace.
- If there is a significant tilt to the graph that would result in the axes lines not being parallel to the sides of the image, re-scan the image and adjust the axes so that they are parallel to the sides of the paper.

Question: What if UN-SCAN-IT follows the horizontal axis line?

Answer(s):

- During the setup process, define the vertical limits slightly above the lower horizontal axis line and slightly below the upper horizontal axis line.
- If there is a significant tilt to the graph that would result in the axes lines not being parallel to the sides of the image, re-scan the image and adjust the axes so that they are parallel to the sides of the paper.

Question: What if UN-SCAN-IT gives inaccurate results?

Answer(s):

- Carefully and accurately define the axes locations and values during the setup process.
- Confirm that the original graph is on a continuous linear or logarithmic scale and accurately plotted.
- Ensure that there are no stray marks near or crossing the data line being digitized.

Note: There are inherent uncertainties regarding the conversion of any graphic image into data. UN-SCAN-IT (and all (x,y) digitizing software) simply makes the best approximation for each image by converting the pixel locations into meaningful quantitative data. The experience and expertise of the scientist is a crucial factor in obtaining accurate results from any digitizing software package.

Question: What if UN-SCAN-IT reduces peak heights when digitizing?

Answer(s)

- If the graph has sharp peaks, do not use the Both Surfaces (Mid-Line) point assignment. Surface of Line point assignment is far superior for graphs that contain sharp peaks.
- If the graph has upward peaks, then make sure you selected Upper Surface of Line (and conversely for downward peaks).

Question: Can the graph be digitized if the original is on paper too large to fit the scanner?

Answer(s):

- Photo-reduce the original to a size that can be easily scanned.
- Scan only the portion of the paper that contains the graphical image.
- Scan the image in pieces, and later append the digitized data points. It is crucial that each piece scanned contain proper scaling marks if the data is to be properly digitized and appended.

Question: How can additional data points be digitized when the data memory is full?

Answer(s):

- Save the data that have already been digitized using the **Save Data** feature from the **File** menu. Then clear the data from memory using the **Clear Data** feature from the **File** menu. Resume digitizing by selecting **Return to Current Image** option from the **Digitize** menu.
- Collect the digitized data at a lower resolution.
- Scan the original graph at a lower dpi resolution.

Question: What can be done if UN-SCAN-IT gets lost?

Answer(s):

- Re-define the single pixel Data Line Color that you wish to digitize.
- Erase grid lines or other stray marks that may cross the data line.
- If the software is skipping to other data lines or marks, ensure that the data line of interest is a continuous curve.

Appendix C

NEW VERSION 7.0 FEATURES

Overview

This appendix provides a brief overview of some of the new features of UN-SCAN-IT Version 7.0. Most of these features are described in further detail in the body of this manual.

Scalable Main Image View

The main image view can be set to maintain the aspect ratio of the original image. This eliminates the undesirable stretching that sometimes occurred when the original image is stretched to fit the digitizing screen.

Zoomable Main Image View

When the main image view is set to maintain aspect ratio, the image view zoom level can be selected as 1x, 2x, 4x, 8x and 100% values. This allows a closer inspection of the positioning of the setup icons, and also provides a more detailed view of the positions of the digitized data points. Note: Automatic Digitizing may be slower while image is zoomed.

Integrated Digitizing and Graphing Screens

It is now possible to go directly from the digitizing screen to the graphing screen, and also to return directly from the graphing screen to the digitizing screen. This feature allows the addition, deletion, modification, and display of the digitized data values between the digitizing and graphing screens to be virtually seamless.

Toolbar Shortcuts

Many of the most common menu selections from the UN-SCAN-IT menus can now be accessed more easily using the toolbars located below the menus. Some of the toolbar options include shortcuts to the digitizing screen, graphing screen, pause button, speed settings, zoom settings, help menus, line types, and data copying and saving features.

Integrated Digitizing and Graphing Spreadsheets

Both the digitizing screen and the graphing screen contain spreadsheets that display the (x,y) data values in real time. These spreadsheets can be useful in tracking and modifying the (x,y) data values during the digitizing and graphing process.

Turbo Mode

A new digitizing speed setting (Turbo Mode) is available that allows data points to be digitized extremely quickly (30,000+ points per second). Turbo mode does not display the crosshair movement, digitized data points, or the data spreadsheet as the points are being digitized. This mode is useful when maximum digitizing speed is required and no user interaction will occur.

Increased Number of Data Points

The maximum number of digitized (x,y) data points has been increased to 100,000 data points per file.

Vertical Data Shifter

A graphical data shifter tool has been integrated in the digitizing screen to allow selected digitized data points to be shifted up or down to better fit the graphical image.

Additional Image Formats and Larger Image Support

The software supports additional graphic image formats, and can load images larger than the previous 32000 x 32000 limit.

New Context Sensitive Help Buttons and Tooltips

Context sensitive help buttons are now located adjacent to many of the setup and digitizing options. In addition, descriptive tooltips are displayed when the mouse moves over the controls and icons.

Larger Setup Icons

The digitizing setup icons are larger and clearer to improve user interaction during the setup process.

Customizable Data Eraser

The size of both the data eraser and data shifter can now be customized to improve precision.

Improved Graphing Features

The graphing screen now includes new line types, improved X data spacing adjustment, additional screen colors, and smooth point sizes.

Glossary

1-bit Image - This type of image contains only a single pixel color, and is used to represent line drawings. This format is also referred to as **Line Art** or **Black & White**.

8-bit Grayscale Image - This type of image contains 8 bits per pixel, and represents each pixel with one of 256 shades of gray. This format is also referred to as **Black & White Photo**.

24-bit Color Image - This type of image contains 24 bits per pixel, and represents each pixel with one of 16,777,216 colors.

ASCII (text) - ASCII format is a universal data format used by most computers for data and text exchange. UN-SCAN-IT can export data in both tab and comma delimited ASCII (text) format.

Black & White Image - This type of image contains only a single pixel color, and is used to represent line drawings. This format is also referred to as **1-bit** or **Line Art**.

Clipboard - Both Windows and Macintosh computers have a temporary location in memory where data or graphics can be placed. This Clipboard region can be used to transfer data between programs. UN-SCAN-IT can export data to the computer's **Clipboard**, and the data can be pasted into other applications.

Colored Line - Most scanners and image input devices represent colored lines by a mixture of pixels of varying colors. UN-SCAN-IT uses a color approximation algorithm to digitize colored data lines and points.

Contiguous Data Point – A data point that is comprised of a set of contiguous (i.e. touching each other) pixels of a defined data color.

Data Eraser - A graphical eraser box used in the digitizing or graphing screen to delete underlying data points from memory.

Digitizing Process - The process of converting raw pixel locations and intensities into useful scientific data.

dpi - Dots per inch (dpi) resolution of an image. Digitizing a 10 inch long graph that was scanned at 300 dots per inch will produce approximately 3,000 data points in line follow mode.

Image Input Device - Any device (such as a scanner or digital camera) that will capture a hard copy image and convert that image into a useable computer format (e.g. jpg, tif, .bmp, etc.).

Image Stretching – When the Stretch to Fit option is selected for the main image view, the entire image will be stretched to fit within the main digitizing window. Although the digitizing results will not be affected, it is often preferable to select the Maintain Aspect Ratio option to preserve the original image width to height ratio when displaying the image in the main digitizing windows.

Full Scanner Resolution - The image will be digitized at full scanner resolution, and is not limited to screen resolution. Therefore, scanning the image at a higher **dpi** setting can improve the resolution and accuracy of the digitized data (i.e. digitizing a 10 inch long graph that was scanned at 300 dots per inch will produce approximately 3,000 data points).

File Types (Data) - UN-SCAN-IT can export data in both tab delimited and comma delimited **ASCII (text)** format. This format can be imported into nearly all spreadsheet and data analysis programs. In addition, the data can be saved to the computer's **Clipboard** and pasted into these applications.

File Types (Image) - There are a number of commonly used image file types supported by nearly all scanners and digital cameras. UN-SCAN-IT can import and digitize most of these common file types such as JPG, TIFF, PNG, GIF, and BMP.

Grayscale Intensity Width – A user defined range for the grayscale values that UN-SCAN-IT will accept as data.

Horizontal/Vertical Range – A user defined range for the grid line filter window used to ignore grid lines during grid line filtering digitizing.

Line Art Image - This type of image contains only a single pixel color, and is used to represent line drawings. This format is also referred to as **1-bit** or **Black & White**.

Line Following Algorithm - The method that UN-SCAN-IT uses to follow and assign an (x,y) data value to each point along the curve. This method involves many considerations, such as line thickness, tilted graphs, intersecting curves, grid lines, etc.

Resolution - Although the resolution (number of pixels in each step) can be adjusted in the *Options* portion of the software, UN-SCAN-IT generally operates at a resolution of one scanner unit. Therefore, digitizing a 10 inch long graph that was scanned at 300 dots per inch will produce approximately 3,000 data points. The digitized data resolution can be further adjusted using the **Adjust X Data Spacing** option in the graphing screen.

Single Valued – A curve or function that has only a single y value for each x value along the curve. Circular graphs, drawings, etc. are not single valued.

Vertical Data Shifter - A graphical data shifter box used in the digitizing screen used to shift the selected digitized points vertically.

X Data Spacing - The (x,y) values of the digitized data are extracted directly from the pixel locations on the original image. Although the x values may have what appear to be arbitrarily assigned x spacing, due to the conversion of a pixel location to an (x,y) value, the spacing can be Adjusted to any user defined increment. The **Adjust X Data Spacing** feature (located in the **Graphing** portion of the UN-SCAN-IT software) is useful for aligning x spacing in order to graph multiple curves on the same scale using other graphing software or to set x data points to exact user specified values.