



WinPLOT

WinPLOT 0.8 Contents:

The Contents lists Help topics available for WinPLOT.

To learn how to use Help, press F1 or choose Using Help from the Help menu

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WinPLOT

About WinPLOT:

WinPLOT Features:

Interactive operation including Zoom-Pan-Scroll along with point-by-point analysis.
Cartesian, Polar and LOG scales with up to 16 signals by 32000 samples.
Customizable line/symbol color, size and type with postscript quality printer output.
Batch file like automatic operation for use with data acquisition systems or your own programs.
Basic signal processing including: spectral analysis, integration, differentiation and various statistics.

Focus:

WinPLOT was written out of a need for a simple yet effective data analysis tool for engineers and scientists. WinPLOT was designed specifically for basic graphical data analysis, and thus is easy to use and inexpensive. WinPLOT combines some of the best features from an assortment of other more expensive data graphing and analysis products. On the other hand, WinPLOT is not intended for business type presentation graphics and thus does not support fancy 3-D bar charts etc.

Shareware:

WinPLOT is a shareware product and thus you are encouraged to copy and distribute this program. You may not however alter the contents of any file or distribute known passwords. If you find this program worth the minimal cost then you must register to fully activate it.

Version: 0.8 (Beta - in development)

Written by: Paul Woodworth (CompuServe 75330,746)
In Touch Software
27934 Redwood Glen Rd.
Valencia, CA 91354

See Also

[Version - Features](#)

[Warranty](#)

Version - Features:

- 0.7 5/1/93 First public release
- 0.8 10/1/93 Relaxed shareware restrictions
 - Fixed interactive operation
 - Improved performance of plotting by 30%
 - Settings for Active and Symbol size are now saved
 - Added data header editing capabilities
 - Added data statistics window.
 - Added Signal Processing
 - Spectrum, Integration, Differentiation
 - Added signal generator selection application

See Also

[Known Anomalies](#)

[Warranty](#)

Installation:

This program requires Microsoft Windows 3.0 or above running standard or enhanced mode to operate.

Automatic installation:

WinPLOT can be automatically installed by running the INSTALL program on the WinPLOT disk:

From the Program Manager: <File> <Run>

```
A:INSTALL
```

Manual installation:

Copy the uncompressed files to any existing directory.

```
COPY a:\*.* c:\winplot\ (Note: it is best not to copy the files directly into your DOS  
or Windows directories)
```

```
COPY a:\vbrun200.dll c:\windows\system\  
COPY a:\grid.vbx c:\windows\system\  

```

Then from any existing window group in the Program Manager press:
menu <File> item <New> option <Item> button <Browse> then select WINPLOT.EXE

See Also

[WinPLOT Files](#)
[Registration](#)

WinPLOT Files:

WinPLOT files: (files copied to your directory of choice)

WINPLOT.HLP	45 Kb	The help document you are reading
WINPLOT.EXE	332 Kb	The Win PLOT Visual Basic program
DATA_EXL.XLS		Excel data set (Input to EXCEL)
DATA_EXL.CSV		Text file data set (Output from EXCEL)
DATA_LST.EXE		A small program used to select .BAS signal files
DATA_GEN.BAS*		BASIC source code example for generating signals.
DATA_FFT.BAS*		BASIC source code example for FFT

*note: these file require a BASIC development system such as MS QBASIC includes

with

MS DOS 5.0.

System required file: (copied to your system directory if they don't already exist)

Note: these files are supplied from Microsoft

VBRUN300.DLL	395 Kb	Required to run Visual Basic (3.0) programs.
GRID.VBX	45 Kb	Required Visual Basic eXtension for grids.

Install files: (these files can remain on your the installation disk)

INSTALL.EXE	The installation program
SETUPKIT.DLL	required for the install program
VER.DLL	required for the install program

Running WinPLOT

WinPLOT is run by simply double clicking on the WinPLOT icon. When you first run WinPLOT it will initialize itself with your operation system which will generate a unique 3 digit installation number. To register your copy see the Registration section

Alternatively you can pass WinPLOT a data file to load from the startup command line:

```
WINPLOT filename
```

Where `WINPLOT` is the WINPLOT.EXE application and `filename` is the file to load - including path if necessary. This feature allows batch operation. To utilize this option under the Windows File Manager you should use File Associate under the Windows Program Manager. This will allow you to invoke WinPLOT for particular data file extensions.

Data File Formats:

Data for WinPLOT can be imported from an ASCII file in a row-column format. At the top of the data file is the data header. This data header is very important and is the key to efficient WinPLOT utilization. (See WinPLOT Data header) Below the DATA keyword starts the actual data. Each row (line) is one set of data points while each column defines each signal. Each column is separated by either a comma (ASCII 44) or a series of spaces (ASCII 32) and each line is separated by a carriage return - line feed (ASCII 13 - 10).

Example:

ASCII Text File: (space character separation)

```
comment This is a test of a ASCII data set  <-- comment line (spaces allowed)
signals time      range      altitude
units   sec       miles     feet
DATA                                         <-- required if header included
      1      23.123    9.99e-099
      2      24.005    8.80e-088
      3      25.701    7.00e-077
      4      26.409    6.00e-006
```

It is important to note that the first set (line) of data defines the right most column that the following data sets must be contained within. This is done for speed so that the program does not have to parse each line individually. Note that at a minimum you must leave space for the sign and a space to separate the numbers. For example:

```
DATA
 2.00 23.123      999999  <-- defining line (note extra space for sign)
-1.20 25.7        7000    <-- OK the sign is intact
 2.00 26.000  77    <-- OK the last number is still right bounded = 77
 2.3e4 26.4      6666   <-- ERROR the exponent will be lost = 2.3
```

ASCII Text File: (comma character separation)

If the columns are separated by commas it is said to be a Comma Separated Values (CSV) file. CSV files do not need to be any space between numbers and are therefore smaller. (See example below) Another advantage of CSV files is that in WinPLOT a blank column is allowed in the data for descriptive purposes but is ignored during import. See the Excel data file section for an example.

```
DATA
2.00,23.123,999999
-1.20,25.7,7000
2.00,26.000,77
2.3e4,26.4,6666
```

MathCAD:

Data can be imported from MathCAD using the WRITEPRN command. Note that the PRNCOLWIDTH must be greater than the PRNPRECISION so that the data columns are right justified. Thus to include the sign (1), the exponent (5) and space (1):

$$\text{PRNCOLWIDTH} \geq \text{PRNPRECISION} + 7$$

PRNCOLWIDTH and PRNPRECISION are Built-In Variables available under the Math menu.

See Also

[ASCII File Format](#)

MATLAB:

Data can be imported from MATLAB using the SAVE command.

```
save file variable /ascii           for 8-digit ASCII output  
save file variable /ascii /double  for 16-digit ASCII output
```

where *file* is the output file name and *variable* is the MATLAB variable to be output.

See Also

[ASCII File Format](#)

EXCEL:

Data is imported from EXCEL as a CSV (Comma-Separated Values) file using File Save As. An example of an EXCEL (ver 3.0) file for use in WinPLOT is contained in the file DATAEXCL.XLS. Note that the first column blank ignored automatically if it is blank.

Below is an example of an EXCEL .CSV file: (Note comma place holders and blank first column.)

```
COMMENT,This is an example of an EXCEL data set,,
DATASET,Test,,
DATE,2/18/93,,
TIME,1:23:45.6789,,
PLOT_TYPE,rectangular, ,
SET_Y,-0.3,1.1,
PRINT,5,7,L
SIGNALS,X,Y=Sin(X)/X,diff(Y)
UNITS,sec,feet,feet/sec
```

```
DATA,,,
,-6.2832,2.30E-06,-2.30E-06
,-5.8832,-6.62E-02,6.62E-02
,-5.4832,-0.13083,6.46E-02
,-5.0832,-0.18336,5.25E-02
,-4.6832,-0.21344,3.01E-02
,-4.2832,-0.2123,-1.14E-03
```

See Also

[ASCII File Format](#)

Signal Generation

Signals can be generated easily using BASIC such as QBASIC which is included with MS DOS 5.0.

```
Open "C:\WINPLOT\DATA.CSV" For Output As #1 ' Open your output file
Print #1, "COMMENT, This is a BASIC generated file"
Print #1, "SIGNALS, x, sin(3x), cos(x), x/10, sqr(x)/2"
Print #1, "DATA"
For x = -1.5 To 5 Step .01 ' Define X range and resolution
  Print #1, x; ", "; ' output X axis
  Print #1, Sin(3 * x); ", ";
  Print #1, .5 * Cos(x); ", ";
  Print #1, x / 10; ", ";
  Print #1, Sqr(Abs(x)) / 2 ' last signal has no ";", ";
Next x
Close #1
```

See Also

[ASCII File Format](#)

The WinPLOT data header:

One of the most important items to consider using WinPLOT is the data header of the import file. The data header can be used to specify most all important aspects of your signal plotting. The WinPLOT data header is loosely based on the data header used by DADiSP. ([see: differences between WinPLOT and DADiSP](#)). WinPLOT has two basic modes of file import operation -user specified X-axis values or a sample based generated X-axis.

NOTES:

Keywords must start in the first column.

Keywords and items are not case sensitive.

Keywords are not order dependent except for keyword DATA just before first line of data.

Not specifying a keyword causes the default to be used.

Some Keywords accept multiple items, the DATA keyword has no items.

Keywords and items can be separated by commas "," or spaces " "

Commas "," can be used as place holders - spaces cannot

Do not use spaces or commas in individual item names, except for the COMMENT line.

Do not mix spaces and commas on the same line since a comma has higher priority than a space.

Option 1: Standard user defined X and Y axis

Keyword	Example-Item	Default-Item	Description
COMMENT*	This is a comment	-none-	General comment
DATE*	11/10/62	(today)	Date stamp
TIME*	10:50:00	(now)	Time stamp
PLOT_TYPE	POLAR, NOGRID	rectangular,grid,legend	Set plot type, grid display,legend display
SET_X	0, 6.28	autoscaling,linear	Set X axis start, end and type.
SET_Y	-10, 10, log	autoscaling,linear	Set Y axis start, end and type
SIGNALS*	Time, Range, Alt...	samples,signal_1,...	Define signal names
UNITS*	Sec, Miles, Feet,...	-none-	Define signal units.
DATA	PRINT,3,5	-none-,7,5	Print plot, width, height Keyword DATA required for the header Use PRINT only for batch mode

operation

* NOTE: These items can be edited using the Data Header (F3) window.

Option 2: Sample based defined X-axis (DADiSP compatible)

VERT_UNITS	Miles, Feet,...	signal_1,signal_2,...	(Replace keyword UNITS)
HORZ_UNITS	Sec	samples	(Add)
INTERVAL	0.01,5 offset	1,0	(Add) Define X-axis values interval,

See Also

[ASCII File Format](#)

[DADiSP File Format](#)

Loading a Data File:

File Open: (F2)

Use <File> <Open> to access the data file import screen. To help in selecting your files there are filter options that can be selected. The first filter option is fixed the *.CSV and the last 'filter' is all files *.*. The middle filter option is variable and is set to your current data file extension.

Printing:

WinPLOT uses the print drivers available under Windows, thus the printout will be at the highest possible resolution or your printer. Select the width and height of your plot area - the titles and scaling numbers etc. will be outside of this area. Note that the current page orientation and size is displayed in the status box.

Center Plot	Center the plot otherwise defaulted to the upper left corner.
Solid Lines	Allows a wider solid line to be printed so it stands out from the grid. Use symbols to differentiate your signals in this case.
Information	Allows data set information to be printed below the plot
Form Dump	Does a Screen Dump of the WinPLOT application to the printer.

Save Settings:

The Save Settings menu item will save the following current settings:

- Path, file, file extension*
- Plot type*
- Active mode on/off
- Auto-redraw on/off
- Grid on/off*
- Legend on/off*
- X, Y scaling log/lin*
- Symbol & line size, style, type and color

* NOTE: These items will be superseded if they are specified in the [data file header](#).

Multiple WinPLOT sessions:

To view multiple data sets simply run another session of WinPLOT. Type menu <File> item <New Session>. Windows supports as many instances of any program until system resources run out.

Data Information:

Information on the current data set is displayed.

current data file
of signals
of samples
--- for each signal ---
Max
Average
Min
Zero crossings
Local extrema

Viewing Data:

Display Redraw: (F5)

Redraw forces the redrawing of the plot. This function is necessary if the Auto Redraw option is turned off.

Display Auto Scale: (F6)

Forces one time automatic scaling of the plot area for

Alternatively the plot area can be scaled in other ways:

- 1) Specify the X or Y values in the data header.
- 2) Manually change the X or Y values in the plot
- 3) Use the mouse to select the area to view (Zooming)

Data points, Line styles, and Colors: (F4)

The data points can be seen by setting their symbol types. i.e. box, cross etc.

The lines can be differentiated by line styles. i.e. dot, dash etc.

The data and line colors can be selected

The physical size of the symbol depends on the physical size of the X-axis, however, the relative symbol sizes can be selected between a range of 1 to 4.

Display Skip Points:

You can select this option if your data is over sampled or if you want to speed up your plots.

Display Grid:(F9)

The grid is automatically scaled based on the range of the values and the plot type.

Linear:

The WinPLOT grid spacing will automatically adjusted to either a unit (1) or a half unit (.5) spacing offset from the 0,0 origin. Thus you will see anywhere from 4 to 20 grid lines along an axis. The value of the grid spacing is displayed along side of the axis as "xxx/div".

Log:

WinPLOT will always display 10 lines per decade for a log scale. The grid spacing along the axis will be labeled as "log". Note that there is a limit of 10 decades for Log scaling.

Polar:

For a POLAR plot the angular displacement(θ) is marked in 10° divisions while the magnitude (r) is displayed as either Linear or Log scaling as shown above.

Display Legend:(F11)

You can turn off the display of the legend with this option. The legend will appear inside of your plot area and can be moved (dragged) out of the way of a signal if necessary. (Note that the plot must be Active to move the Legend.) During printing the legend will appear outside of your plot starting at the upper right corner.

Display Active:(F12)

NOTE: To use interactive investigation of the data points, the Display must be Active.

Operation	key	mouse
Next signal	<Up arrow>	
Previous signal	<Down arrow>	
Previous data point	<left arrow>	move mouse to the left
Next data point	<right arrow>	move mouse to the right
First data point	<Home>	
Last data point	<End>	
Zoom in about current point	<Insert>	drag mouse across area
Pan back form current point	<Delete>	

Aborting Plotting

During drawing of multiline plot you can abort the following lines by pressing the period key "."

Plot Types:

There are essentially three different ways to view data in WinPLOT:

1. Rectangular:

A rectangular is a standard Cartesian X,Y plot

2. Histogram:

A histogram is a bar chart. x,h

3. Polar:

A polar plot is a amplitude (r) angle (θ) display. The "X" (θ) data must be between 0 (0 deg) and 2π (360 deg) or the plot will wrap around itself.

The X or Y axis data can be viewed as a linear or logarithmic format. Note that in POLAR you cannot select a Y-log option. Also a negative value to be displayed in a LOG format will generate an error condition.

Limitations:

Currently only 16 signals can be defined.*

Currently only 32767 points per signal can be used.*

Log scale is limited to 10 decades.

Signals & Unit names are cut after 12 characters.

Currently single precision is being used, thus a Max range of data is $\approx \pm 3E\pm 38$

*** NOTE: An unregistered copy of WinPLOT is limited to 2 signals at 200 samples.**

See Also

[Known Anomalies](#)

Known Anomalies:

When installing WinPLOT under Norton Desktop, a DDE error may occur after initial installation. Simply select close connection when the error prompt occurs.

The X-axis bounds are not checked on a printout and thus one extra data sample will appear in your printouts if your X data points exceed the X-axis scaling.

A polar plot requires that the X-axis be equal or larger in physical size (aspect ratio) than the Y-axis.

The polar Y-axis LOG function returns incorrect results.

The PRINT item in the DATA line of your data header is ignored

If you change the setup of the printer, you must exit and restart WinPLOT to recognize the new printer format.

The following have not been fully integrated and are thus disabled:

(none)

See Also

[Warranty](#)

Features to be added at a later date - version:

Dynamic Data Exchange (DDE):

WinPLOT will act as a client to a various Windows applications, for example, an EXCEL spreadsheet. This will allow your data to be displayed dynamically without having to generate an intermediate data file. (The ability to have WinPLOT act as a DDE server to other Windows application has not yet been investigated.)

PLOT exporting:

Direct support for Windows Meta Files to allow vector based drawings to be used by other windows applications.

Binary data files:

Binary data files offer significantly better data file compression and speed. However, the binary data files must be carefully generated for proper operation. Note also that binary files are not directly transferable across different computer systems where ASCII files are.

Context sensitive on-line Help:

The current on-line help is not contextually connected to the program

See Also

[Warranty](#)

Dataset Header compatibility with DADiSP:

The DADiSP data file format is based on a sample based input, thus, the X-axis (signal) is generated during import. WinPLOT can support both a user specified X-axis or a sample based X-axis. The key word INTERVAL tells WinPLOT that the X-axis is to be sample generated.

Supported

COMMENT	General comment
DATE	Date stamp
TIME	Time stamp
SIGNAL[S]	Define signal names.
VERT_UNITS	Define the Y-axis signal units.
HORZ_UNITS	Defines the X-axis for sample based unit.
INTERVAL	If this line exists then WinPLOT will add a X sample based signal (0) and HORZ_UNITS is used to label it. WinPLOT also will support an offset value if one is specified.
DATA	Required if header is included

Not Supported = ignored by WinPLOT

VERSION	Version numbers are not used
FILE_TYPE	File type is currently always ASCII
DATA_TYPE	Data import type only for BINARY files
SAMPLE_RATE	Use INTERVAL (INTERVAL=1/SAMPLE_RATE)
CHAN_NAME	Use SIGNAL keyword
STORAGE_MODE	Storage mode is always INTERLACED
NUM_SIGS	The number of signals is determined automatically
NUM_SAMPS	The number of samples is determined automatically

New - WinPLOT only

SET_X	Set X axis start, end and type.
SET_Y	Set Y axis start, end and type
PRINT	Cause a automatic printout if PRINT item one the same line as keyword DATA
PLOT_TYPE	Set plot type
UNITS	Define both the X-axis and Y-axis units, the X-axis being the first one specified. Use this instead of VERT_UNITS and HORT_UNITS

Example of a DADiSP and WinPLOT compatible file:

```
SIGNAL      sin5 sin8
VERT_UNITS  5sin 8sin
HORZ_UNITS  sec
NUM_SIGS    2                <- WinPLOT will ignore this line - counting automatically
INTERVAL    0.025
DATA
.7071068 , .9510565
1 , .5877852
.7071067 ,-.5877854
```

See Also

[WinPLOT Data Header](#)

Digital Signal Processing:

Any signal analysis by a computer is by definition Digital Signal Processing (DSP).

WinPLOT will perform the following operations:

<u>Spectrum</u>	Determine the frequency content of a signal
<u>Integration</u>	Determine the area that is accumulated by a signal.
<u>Differentiation</u>	Determine the rate of change of a signal.

Spectrum:

WinPLOT will transform each signal to its spectral content. The "spectrum" is defined as the real part (magnitude) of the first half of the complex frequency transform.

WinPLOT uses the standard Cooley-Tukey Fast Fourier Transform (FFT) which requires that the number of samples (N) be a power of 2. ($N=2^M$: ...64, 128, 256, 512, 1024 etc). Therefore, the sample size (length) will be trimmed to the next lower power of 2.

In general it is assumed that all sampling is based on equally spaced sample points. It is also very important to use an appropriate sample rate for accurate spectral analysis.

An "S" will be appended to the signal name.

See Also

[Spectral Analysis](#)

[Digital Signal Processing](#)

Spectral Analysis

When using the FFT it is very important to understand the relationship of the signal that is being sampled, the sample rate and the length of the observation.

(See the DATA_FFT.BAS file for the following examples)

- 1) The sample rate (frequency) must be at least twice as fast as the signal you are sampling.
(Nyquist sampling rate)

Example:

If you wish to observe signals that are up to 20 Hz then the sample rate must be at least 40 Hz.

- 2) The frequency resolution of the transform is: (number of samples)/(sample rate)

Example:

If the sample frequency is 40 Hz and there are 128 samples then the number of hertz per sample is: $(40 \text{ Hz})/(128 \text{ samples}) = 0.3125 \text{ Hz/sample}$

It is important to note that if the signal does not land directly on a multiple of the frequency sample then the transformed signal will "bleed" across adjacent filters causing sidelobes.

Example:

$(5 \text{ Hz})/(0.3125 \text{ Hz/sample}) = 16$ or will "land" directly on the 17th sample (1st being 0)

while

$(8 \text{ Hz})/(0.3125 \text{ Hz/sample}) = 25.6$ and thus "lands" between two samples and will cause "sidelobes".

- 3) There is a minimum length (number of samples) in order to resolve two adjacent signals

Example: (From the example above)

$8\text{Hz} - 5\text{Hz} = 3\text{Hz}$ resolution. Thus to "see between" these signals you will need a resolution of 1.5Hz. Therefor the number of samples must be $(40 \text{ samples/sec})/(1.5 \text{ Hz}) = 26.66$ or 32 samples

See Also

[Digital Signal Processing](#)

[Spectrum](#)

Integration:

WinPLOT will integrate each signal using the Simpson integration algorithm.

Note that the that when integrating on the first four points or the last point if an even point the function will use the appropriate methods of the trapezoidal rule. Therefore, if insufficient sampling is done then appreciable errors can result at the end points.

An "i" will be appended to the signal name.

See Also

[Differentiation](#)

[Digital Signal Processing](#)

Differentiation:

WinPLOT will differentiate each signal using a seventh-order central difference formula.

The points $n=1,2,3$ and $n=N-2,N-1,N$ are differentiated using a fourth-order approximation. Therefore, the end points can have considerable errors.

A "d" will be appended to the signal name.

See Also

[Integration](#)

[Digital Signal Processing](#)

Warranty & Agreement:

IN TOUCH SOFTWARE, OR IS OWNERS, DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED.

SHOULD THIS PROGRAM PROVE DEFECTIVE, THE PURCHASER ASSUMES THE RISK OF PAYING THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR, OR CONNECTION AND ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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MathCAD is a registered product of MathCAD, Inc.

MATLAB is a registered product of The Math Works, Inc.

MS-DOS, EXCEL, Windows, QBASIC, and Visual Basic are all registered product of Microsoft Corporation

See Also

[Registration Instructions](#)

Registration Instructions:

In order to keep costs down, we do not provide on-line phone support. If you have specific questions, problems or would like to see new features, please write them down and we will contact you if you want.

Registration Option 1: Protected - Password required - No disk provided

After sending in the [registration form](#) you will receive a 4 digit password code that will properly activate your copy of WinPLOT. To activate your installation go to the About section and enter your 4 digit number in place of the four X's (:XXXX) and then press the 'Register' button. NOTE: If you inadvertently enter the wrong password number and press 'Register' you must then exit WinPLOT and repeat the process.

NOTE: It is absolutely essential that the version # and Installation # are correct as shown on your WinPLOT About screen in order for your password to be correct.

Registration Option 2: Not protected - No password required - Disk provided

After sending in the [registration form](#) you are provided a personalized disk which is not installation protected. This disk will allow unlimited copies (installations) for use by the registered individual or company.

See Also

[Registration form](#)

Registration Form: WinPLOT 0.8

Mail this form to:

**In Touch Software
27934 Redwood Glen Rd.
Valencia, CA 91354**

Name: _____

Phone: (____) ____ - ____ (optional)

Company: _____

Address: _____

City: _____ State: ____ Zip: _____

Registration Option 1: Protected - Password required - No disk provided

New owner: \$10

Registered owner upgrade: \$5

WinPLOT Version #: ____ . ____ (should be 0.8)

WinPLOT Installation #: ____ :XXXX

Registration Option 2: Not protected - No password required - Disk provided

Disk size: 5.25" 3.5"

New owner: \$40

Registered owner upgrade: \$15

Comments, Suggestions or Bugs:

