

NEC-WIN SYNTH

Reference Manual

*Antenna Analysis Software
Version 1.0*

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NEC-WIN SYNTH

Version 1.0

Special thanks to our Beta Users for their ongoing suggestions and support.

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Chapter 1 Introduction

This chapter provides an overview of NEC-WIN SYNTH and its features. It also lists features for all programs in the NEC-WIN Family. The last section is an overview of how to navigate in the Microsoft Windows operating environment.

What is NEC-WIN SYNTH?

NEC-WIN SYNTH is an intuitive program that helps antenna designers quickly and effectively design and analyze antennas. Novice and advanced designers alike will appreciate the power and ease-of-use of this program. Problems that previously took hours to describe using alternate antenna modeling software can now be entered in a fraction of that time. If you have been hesitant to use computational tools because of their complexity, then easy-to-use NEC-WIN SYNTH is for you.

Some of the key features of NEC-WIN SYNTH include:

- **Simple user interface.** The inherent complexity of NEC has been eliminated through use of graphical screens that prompt you to enter the required information.
- **Easy data entry.** NEC-WIN SYNTH makes describing antenna geometry as easy as entering numbers in a spreadsheet. After you enter the start and stop point for each wire, you can easily modify each wire using the cut, copy, and paste features. In addition, entire wires and groups of wires can be rotated, scaled, and moved by accessing the appropriate button command. There is no need to perform tedious math. NEC-WIN SYNTH does all of the math for you.
- **Graphical representation of your antenna.** In order to ensure that your geometry is correct, you can view the antenna structure in the Display Window. This display provides a three dimensional representation of the antenna which can be rotated, panned, zoomed, and printed. You can view individual segments and the corresponding cards in the input files, making it easy to edit your antenna information.

The NEC-WIN Family

NEC-WIN SYNTH is the newest of the products that Nittany Scientific, Inc. has released to support antenna designers. The other products are NEC-WIN PLUS+, NEC-WIN Pro, and GNEC-4. These products differ widely in the level of features provided, price, and usage.

NEC-WIN SYNTH is designed to allow users to quickly build complex antenna structures. NEC-WIN PLUS+ provides a wide range of features that are part of the NEC2 core while retaining a very simple user interface. NEC-WIN Pro is designed for engineers that require more capability than is available through NEC-WIN PLUS+. GNEC-4 adds more power by using the NEC4 core.

Hardware and Software Requirements

To install and run NEC-WIN SYNTH, you will need the following:

- Microsoft Windows 95/98/Me/2000 or Windows NT 4.0
- Graphics 800x600 with 256 colors or greater
- CD-ROM for installation

NEC-WIN SYNTH Technical Support

Nittany Scientific, Inc. offers on-line technical support to registered users through our web site located at <http://www.nittany-scientific.com>, via email at tech-support@nittany-scientific.com, or by fax at (801) 446-1426. Before receiving technical support, you will be required to provide your NEC-WIN SYNTH product registration number.

Before You Contact Us

Save yourself time and money by first consulting this manual and the on-line help in an attempt to answer the question yourself.

- Look in the *Reference and User's Manual*. Use all available documentation to try to find the information you need.
- Try to pinpoint the problem. Check coordinates, analysis parameters, and analysis options for your antenna, and then run NEC-WIN SYNTH again. If appropriate, try building and testing a similar antenna. Look at the examples included in the *User's Manual*.

Contacting Us

Fax: Fax us a printout of your antenna input file with a listing of the expected outputs for your antenna so we can analyze the problem before contacting you. Please include your name, address, phone number, and fax number. Our fax number is **(801) 446-1426**.

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About this Manual

Assumptions

This manual assumes that you are familiar with antenna design concepts. If you do not know these concepts, you should familiarize yourself with them before using NEC-WIN SYNTH.

This manual also assumes that you are familiar with the basics of using your PC. If you are not familiar with using the Windows 95/98/Me/2000 or NT operating system, you can refer to the NEC-WIN SYNTH Navigation section later in this chapter.

How to Use This Manual

This manual is not meant to be read cover to cover. Refer to the appropriate sections for needed information:

- | | |
|-------------------------------|---|
| Chapter 1 Introduction | This chapter gives an overview of NEC-WIN SYNTH and its features. It also lists features for all programs in the NEC-WIN family. The last section is an overview of how to navigate in the Microsoft Windows operating environment. |
| Chapter 2 Installation | Read this chapter to learn how to install and quickly begin to use NEC-WIN SYNTH. |
| Chapter 3 Reference | This chapter describes the NEC-WIN SYNTH features in detail. Refer to this section when you have specific questions about features. |

NEC-WIN SYNTH Navigation

Before you begin to use NEC-WIN SYNTH, let's take a brief look at basic navigation. If you are familiar with Microsoft Windows, you should know this information. Skip this section and go on to Chapter 2.

Using a Mouse

You must have a mouse to operate NEC-WIN SYNTH. If you are unfamiliar with the mouse, here are some mouse basics:

- Moving the mouse moves the pointer. To make a selection, position the pointer on the selection and press the LEFT mouse button. This is known as “clicking on” the selection.
- Sometimes you may need to click twice in quick succession on a selection. This is known as “double clicking.”
- To “highlight” or “select” text, place the pointer at the beginning of the text, hold down the left mouse button and move across the text until the entire area you want to select is highlighted. When you have completed your selection, release the mouse button.
- To “click and drag” an object, place the pointer on the object, then press and hold down the mouse button while you move the mouse. The object will also move. When the object is where you want it to be, release the mouse button.

Pull-down Menus

NEC-WIN SYNTH uses pull-down menus. To access the choices under a menu item, use the mouse to point and click on a selection on the menu bar. The pull-down menu appears. To select a menu item, point and click on that item. To remove the menu without making a selection, move the pointer outside the menu and click.

Buttons

Buttons in addition to the menu bar appear across the top part of the window. To select a button, simply point and click on the button with your mouse.

Multiple Windows

You will use windows to enter geometry information and manipulate pattern plots. You can have multiple windows open at one time, and movement between windows is fast and easy. Simply use the minimize and maximize buttons in the upper right-hand corner of each window.

Minimize Minimizing a window reduces the window to an icon at the bottom of the screen. To minimize a window, click on the minimize button. To restore a window from an icon back to its original size, double click on the icon. You can also choose these options from the Control-Menu Box (see the following section).

Maximize To enlarge the window so that it takes an entire screen, click on the maximize button.

Restore To restore a window from an icon back to its original size, click on the Restore button at the top right of the window.

Close Close the window.

Using the Control-Menu Box

The Control-Menu Box is the small rectangular icon in the upper left corner of a window or the program icon. Click on the button and several window arranging menu choices appear. Typical menu options include:

- Restore** Restore the window to its previous state.
- Move** Move the window by using arrow keys on the keyboard.
- Size** Resize the window by using arrow keys on the keyboard.
- Minimize** Minimize the window to an icon at the bottom of the screen.
- Maximize** Maximize the window to the greatest size possible.
- Close** Close the window.

NOTE: Your choices may vary, depending on the window.

Chapter 2 *Installation*

NEC-WIN SYNTH is designed to be both powerful and easy to use. If you have used Microsoft Windows, you know how to navigate through the program. If you have a basic understanding of antenna design, you should be able to use this program with very little orientation.

NOTE: A quick review of navigation in Microsoft Windows is provided in Chapter 1, Introduction.

This chapter is designed to give you the basic information you need to get up and running on NEC-WIN SYNTH.

The sections in this chapter are:

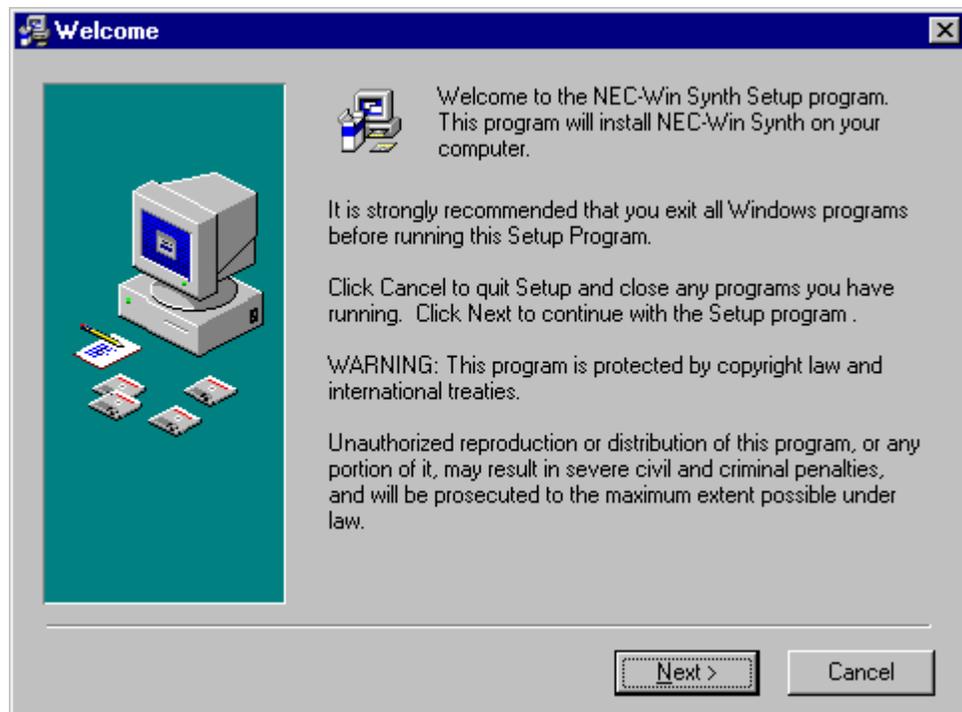
Installation	How to Install NEC-WIN SYNTH on your system.
Starting NEC-WIN SYNTH	How to launch the NEC-WIN SYNTH program.
What's on the NEC-WIN SYNTH Screen?	Overview of what you see on the NEC-WIN SYNTH Screen.

Installation

Follow these steps to install NEC-WIN SYNTH in Windows 95/98/Me/2000 or NT:

1. Place the **NEC-WIN SYNTH** CD in your CD-ROM drive.
2. From the Start button in Windows, select **Run**.
3. At the Start, Run command line, type `D:\NWSYNTH\SETUP`. Then click on OK. (Substitute your CD-ROM drive letter if D: does not match your configuration.)

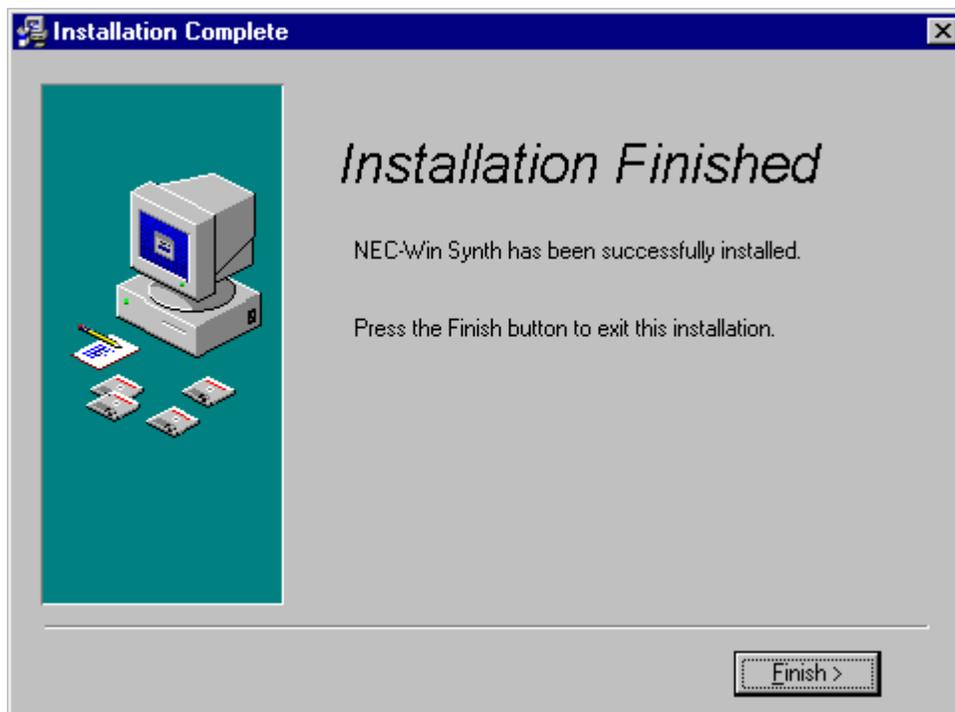
The NEC-WIN SYNTH installation begins. You will then be prompted for the drive and the directory where you want to install NEC-WIN SYNTH (the default is `C:\Program Files\NEC-SYNTH`).



NOTE: NEC-WIN PLUS+ Users

To use NEC-WIN SYNTH with NEC-WIN PLUS+, you should install the program into the NEC-WIN PLUS+ directory. i.e. `C:\NEC-PLUS`. Remove NEC-WIN SYNTH from the install path. i.e. `C:\PROGRAM FILES\NEC-PLUS`. Do not install into `C:\PROGRAM FILES\NEC-PLUS\NEC-SYNTH`.

4. Follow the on-screen directions to complete the installation of NEC-WIN SYNTH.
5. At the conclusion of the installation, you will be asked whether you want to create Program Manager Groups. Click on Yes and the NEC-WIN SYNTH program group will be installed along with the NEC-WIN SYNTH Icon and the Readme file within the program group.



Chapter 3 Reference

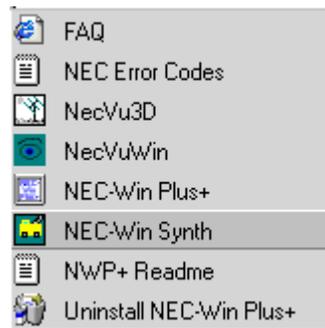
Starting NEC-WIN SYNTH

Once you have installed NEC-WIN SYNTH, follow these simple steps to start the program:

NOTE: NEC-WIN SYNTH can be launched as a stand-alone program, or as an integrated tool from within NEC-WIN PLUS+. Once the program has been started, however, it works the same regardless of how it was launched.

Running from NEC-WIN PLUS+

1. It is very easy to call the NEC-WIN SYNTH program from within NEC-WIN PLUS+. Within NEC-WIN PLUS+, decide which row should be the start of your synthesized geometry and click the right mouse button on that row. In the sub-menu that appears choose "Insert Synthesizer Output". NEC-WIN SYNTH will open and you can generate a model. When finished in NEC-WIN SYNTH, choose Update and Exit. The geometry will then be inserted into the NEC-WIN PLUS+ spreadsheet. In Windows, click on the NEC-WIN PLUS+ Program Group, from the Start button.
2. Even if you have NEC-WIN PLUS+ installed, you can still start NEC-WIN SYNTH stand-alone by selecting Programs, NEC-WIN PLUS+, NEC-WIN SYNTH from the Start button.



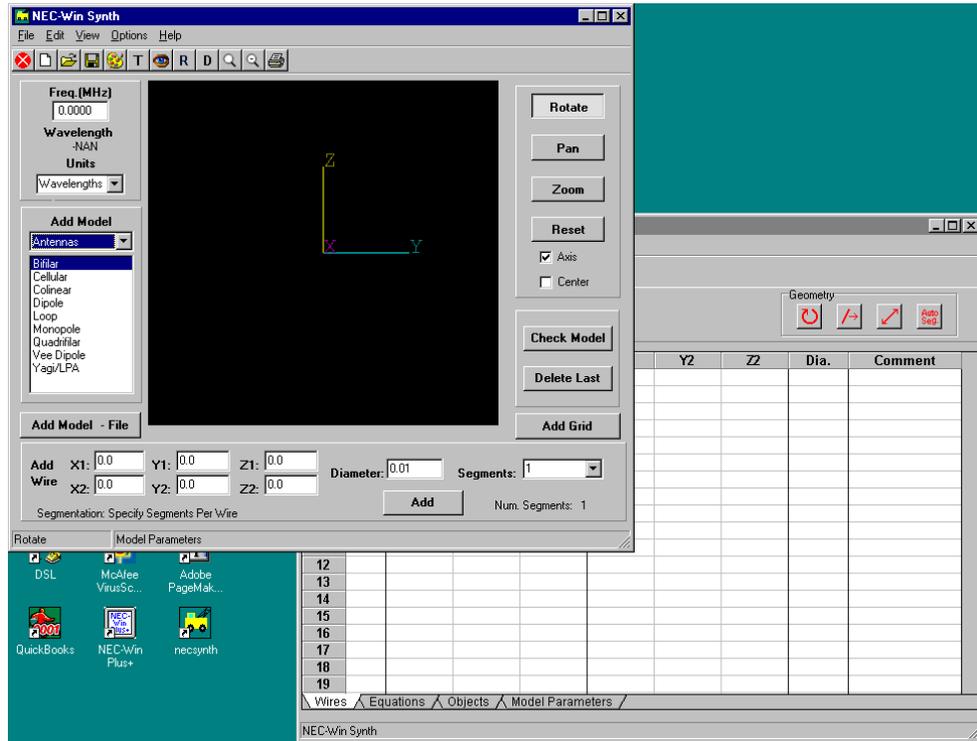
Running as a stand-alone program

1. In Windows, click on the NEC-WIN SYNTH Program Group, from the Start button.

The NEC-WIN SYNTH Program Group contains the NEC-WIN SYNTH icon.



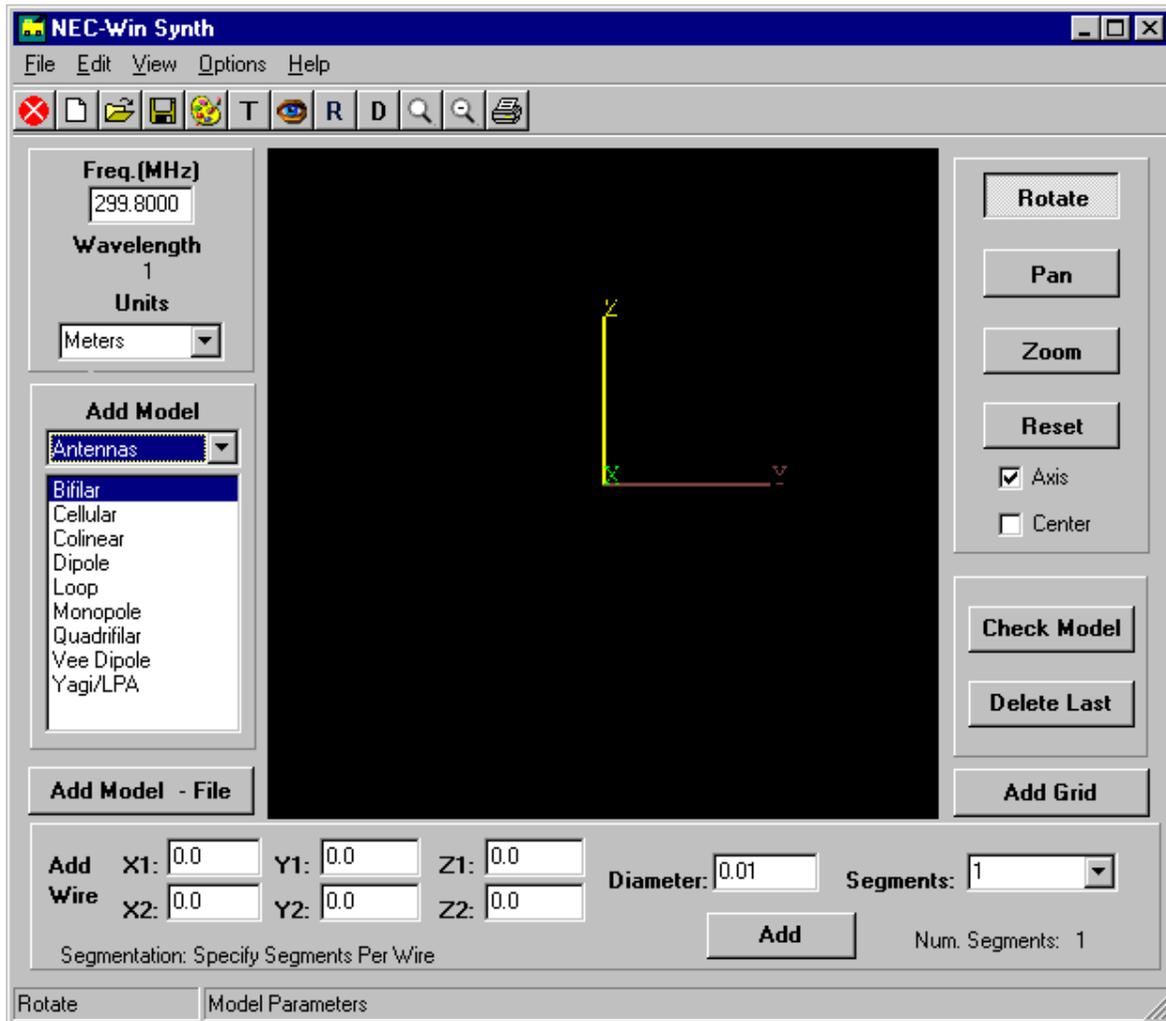
2. Select the NEC-WIN SYNTH icon to start the program. NEC-WIN SYNTH consists of two main interfaces; the Display Window, which is active, and the Spreadsheet.



What's On the NEC-WIN SYNTH Screen?

Once you are in NEC-WIN SYNTH, take a few moments to get acquainted with the screen. There are two main interfaces which comprise NEC-WIN SYNTH, the Display Window and the Spreadsheet. Each consists of three main areas. A description of each area follows.

Display Section



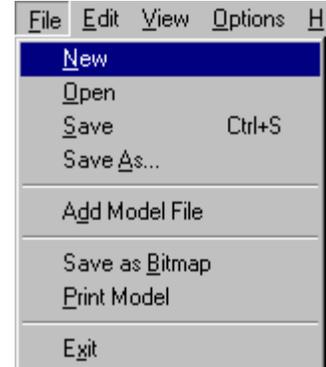
Menu Options

Across the top of the screen is the menu bar, which contains the **File**, **Edit**, **View**, **Options**, and **Help** menus. These menus can be used to select the same functions as many of the function buttons.



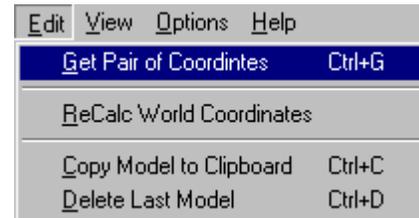
File Menu

From the **File** menu, you can start a new input file with the **New** command or you can access an existing NEC-WIN SYNTH(.NWS) file with the **Open** command. The **Save** and **Save As** commands allow you to save an .NWS formatted file into either the .NEC, ASCII (.TXT) or EZNEC format. **Add Model File** opens a .NEC, .TXT or AutoCAD (.DXF) file. **Save as Bitmap** saves the display in bitmap format. The **Print Model** command allows you to print the display. Use the **Exit** command to exit NEC-WIN SYNTH.



Edit Menu

This menu provides functions for editing the display of your NEC input file. **Get Pair of Coordinates** allows you to connect a new wire between any two existing wires. The **ReCalc World Coordinates** command examines the geometry and resizes the model in the display window to the best resolution to fit the entire model. Use **Copy Model to Clipboard** to copy the display to the clipboard, and **Delete Last Model** to help you to edit your antenna display.



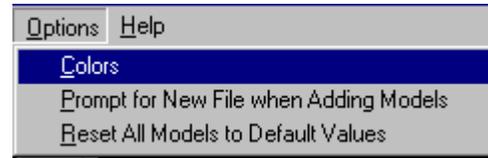
View Menu

The **Zoom Area** and **Zoom Out** commands allow you to zoom a selected portion of the display window or decrease zoom respectively. Selecting **Axis** and **Axis Labels** toggles each feature on and off. **Axis Label Size** allows changing the size of the axis labels. **Show Coord Box Size** controls the size of the boxes that appear when using Get Coordinate or Get Pair of Coordinates. Click on **Center Model** to place the antenna in the middle of the display window. In addition, you can view characteristics of your geometry with the **World Information** option.



Options Menu

The **Colors** menu selection allows you to customize the display colors of your geometry. Select **Prompt for New File when Adding Models** and every time a new model is added you will be prompted whether or not you wish to start a new file. All of the predefined models have default values. As you use the program it will store your values as the default for each model. When you select **Reset All Models to Default Values** ALL of the models will be restored to their default values.



Help Menu

Access on-line **Help** using this option. **About** displays information about the product version.



NOTE: Several of these functions are also available from the buttons on the Function Bar. See the Function Button section for more information on these functions.

Function Bar



This function bar or button bar contains a variety of icon buttons that are shortcuts for many of the functions that are contained in the menus. If you point to the button with your mouse for over one second, a short explanation of the function appears.

Close Display Window



Use this button to close the Display Window.

New Model



Use this button to start a new input file. You can only have one file open at a time.

Open File



Click here to access an existing NEC-WIN SYNTH (.NWS) file.

Save Model



The Save Model button allows you to save an .NWS formatted file into either the .NEC, ASCII (.TXT) or EZNEC format.

Select Colors



Use this button to customize the display colors of your geometry.

Keep Window on Top



This button is available in both the Display and Spreadsheet windows. When enabled the chosen window will remain on top of the other window. Use this feature when the windows overlap each other and you wish to see certain parts of both windows at the same time.

Check Model

Validates the model.



Reset the Display

Resets the rotate, pan, zoom and options in the display window.



Delete Last Model

Deletes the last model from the display window.



Zoom Area

Highlight an area of your geometry and it will be magnified while maintaining focus on the selected area.



Zoom Out

Zooms Out.



Print

Prints the display.



Command Area

Frequency

This is where you change the frequency.

Wavelength

Indicates the wavelength of the chosen frequency.

Units

NEC-WIN SYNTH allows you the ability to choose meters, millimeters, centimeters, yards, feet, inches and wavelengths as units of measure.

Type

The Type controls what category of model you wish to generate. When you modify this value the tabbed control will change accordingly.

Add Model

Each model contains edit fields for parameters that are necessary for that model. To determine how each parameter will affect the model you can view the changes in the status box for each model or easily generate the model and view it in the display window.

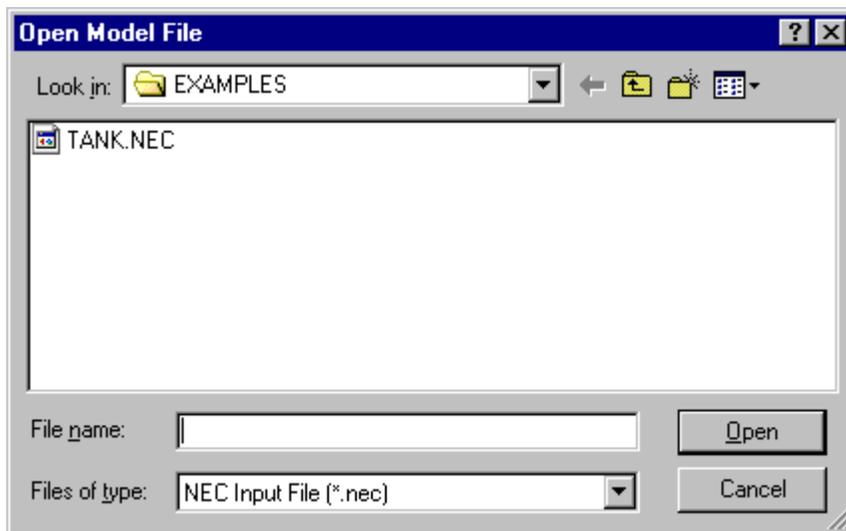
Segments/Wavelength

Some models contains this parameter. The most typical value to use in NEC is 10 segments per wavelength. For critical regions 15 or 20 should be used. In less critical regions 5 is usually sufficient. If other values are desired you can modify the segmentation in the spreadsheet or in NEC-WIN PLUS+ if available.

Add Model - File

Add Model File

This feature allows you to import NEC, ASCII or AutoCAD .DXF files.



Rotate

Rotates the geometry in the display window.

Pan

Moves the geometry around inside the display window.

Zoom

Increase/decreases the size of the geometry.

NOTE: These commands all work by holding down with the left mouse button while moving the mouse. You can scroll through these commands by double-clicking the mouse.

Reset

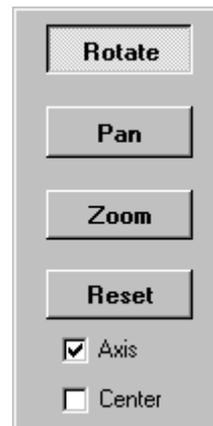
Resets the rotate, pan and zoom options to default.

Axis

Toggles the X, Y, and Z-axes on and off.

Center

Centers the geometry.



Check Model

Press this button to validate the model.

Note: See *Geometry Checker* section in NEC-WIN SYNTH User's Manual for detailed instructions on this feature.

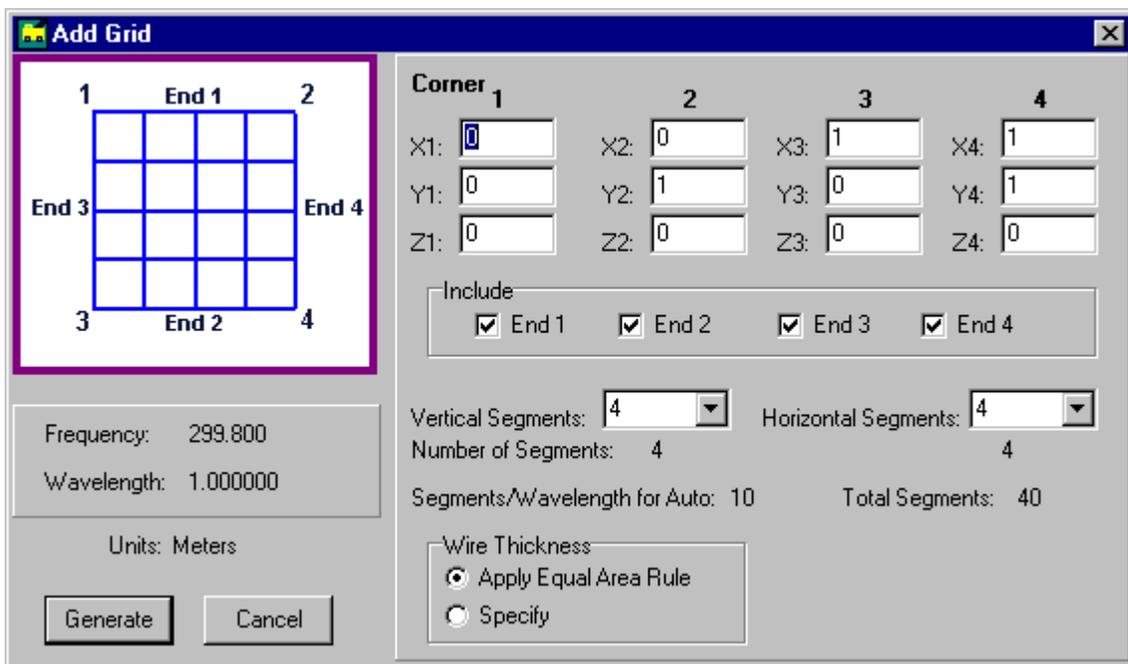


Delete Last

Deletes the last model from the display window.

Add Grid

Allows you to add a wire grid to the model.

The **Add Grid** dialog box contains the following elements:

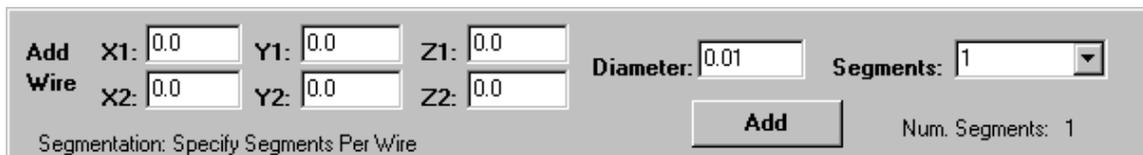
- Diagram:** A 4x4 grid with corners labeled 1 (top-left), 2 (top-right), 3 (bottom-left), and 4 (bottom-right). The edges are labeled End 1 (top), End 2 (bottom), End 3 (left), and End 4 (right).
- Corner Coordinates:**

Corner	1	2	3	4
X:	0	0	1	1
Y:	0	1	0	1
Z:	0	0	0	0
- Include:** Checkboxes for End 1, End 2, End 3, and End 4, all of which are checked.
- Vertical Segments:** 4 (dropdown)
- Horizontal Segments:** 4 (dropdown)
- Number of Segments:** 4 (vertical), 4 (horizontal)
- Segments/Wavelength for Auto:** 10
- Total Segments:** 40
- Wire Thickness:**
 - Apply Equal Area Rule
 - Specify
- Frequency:** 299.800
- Wavelength:** 1.000000
- Units:** Meters
- Buttons:** Generate, Cancel

NOTE: See *Miscellaneous Functions* section in NEC-WIN SYNTH User's Manual for further instructions on the Add Grid feature.

Add Wire

Allows you to add a wire grid to the model.



The **Add Wire** dialog box contains the following elements:

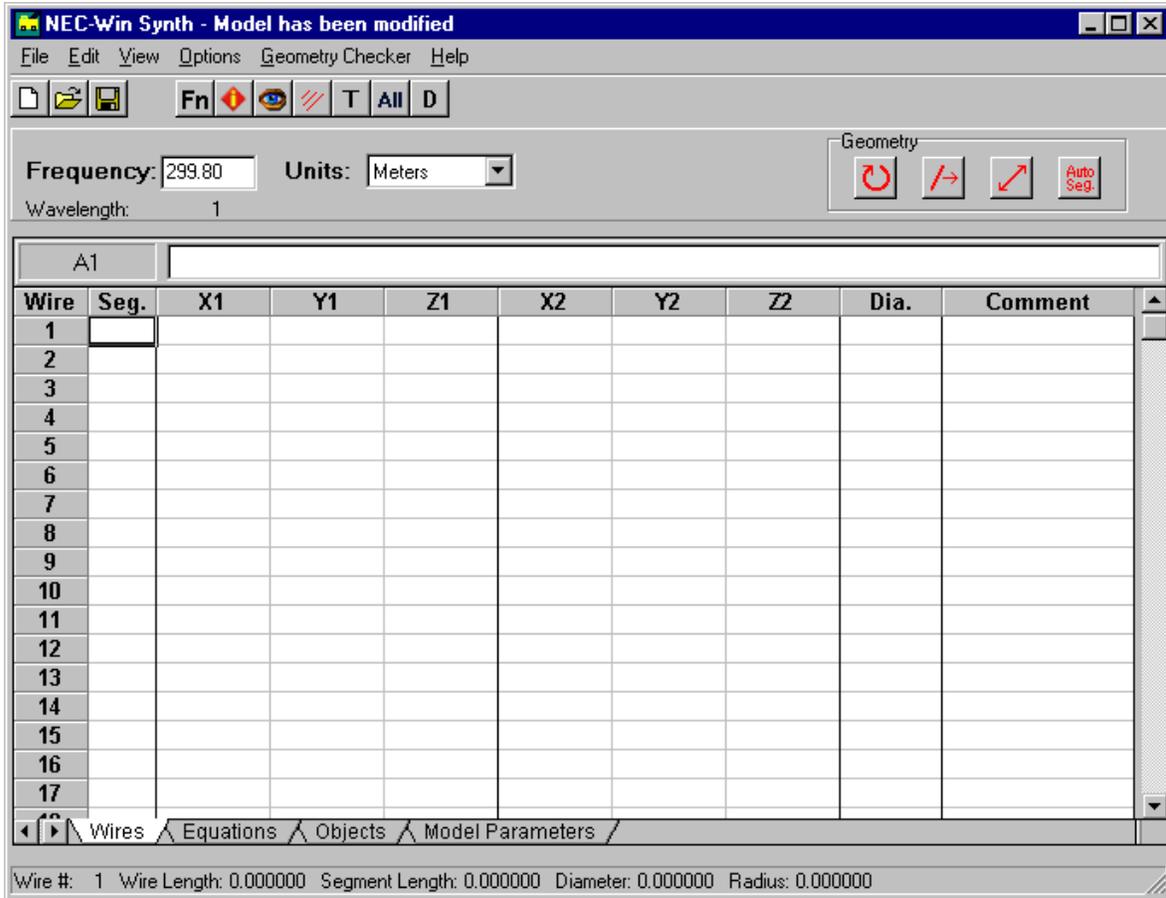
- Add Wire:**

X1:	0.0	Y1:	0.0	Z1:	0.0
X2:	0.0	Y2:	0.0	Z2:	0.0
- Diameter:** 0.01
- Segments:** 1 (dropdown)
- Num. Segments:** 1
- Segmentation:** Specify Segments Per Wire
- Button:** Add

NOTE: See *Example 2* in NEC-WIN SYNTH User's Manual for further instructions on the Add Wire feature.

Spreadsheet

The spreadsheet in NEC-WIN SYNTH is a true spreadsheet. You can enter equations or reference other cells from within.



Menu Options



The following section lists the main menu commands available in the spreadsheet. Across the top of the screen is the menu bar, which contains the File, Edit, View, Options, Geometry Checker, and Help menus. Most of these commands are also accessible from the toolbar or short-cut keys.

File Menu

From the **File** menu, you can start a new input file with the **New** command or you can access an existing NEC-WIN SYNTH (.NWS) file with the **Open** command. The **Save** and **Save As** commands allow you to save an .NWS formatted file into either the .NEC, ASCII (.TXT) or EZNEC format. **Page Setup** provides options for headers, footers, margins and other layout settings. The **Print Setup** and **Print** commands allow you to print customized reports of your antenna information. Use **Print Preview** to see how your report will look prior to actual printing. Use the **Exit** command to exit NEC-WIN SYNTH.



Edit Menu

The menu provides functions for editing your NEC input file. You can select **Copy**, and **Paste** and **Select All** to help you to edit your NEC input file.



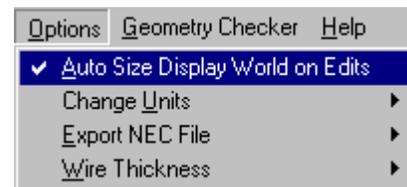
View Menu

The **ReCalc World Coordinates** command examines the geometry and resizes the model in the display window to the best resolution to fit the entire model.



Options Menu

Auto Size Display World on Edits controls whether edits to the model will cause the model to be resized to fit into the display area. For instance, if the model is zoomed and a wire is added which is outside the displayable area, the model will be resized to display the full model.

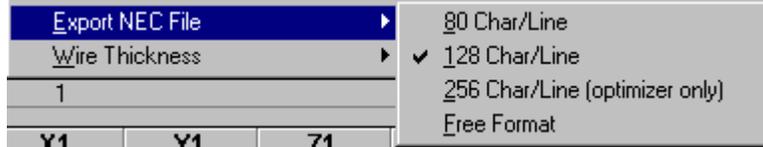


Change Units

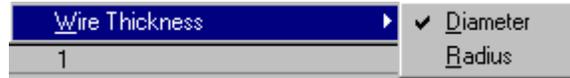
allows you to select the option to change or retain numerical values in your input file when changing the units.



Export NEC File allows you to choose the format of an exported NEC file.

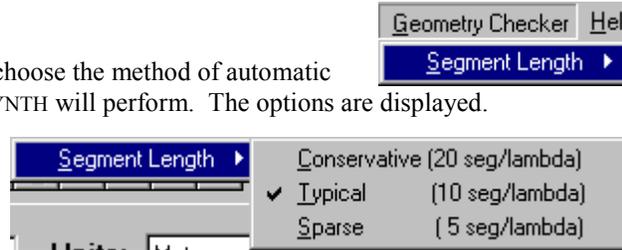


Wire Thickness allows you to select diameter or radius as a measurement.



Geometry Checker Menu

Segment Length allows you to choose the method of automatic geometry checking NEC-WIN SYNTH will perform. The options are displayed.



Note: See **Geometry Checker** section in NEC-WIN SYNTH User's Manual for detailed instructions on this feature.

Help

Access on-line **Help** using this option. **About** displays information about the product version.



Function Bar



This function bar or button bar contains a variety of icon buttons that are shortcuts for many of the functions that are contained in the menus. If you point to the button with your mouse for over one second, a short explanation of the function appears.

New Model



Use this button to start a new input file.

Open File



Use to access an existing NEC-WIN SYNTH (.NWS) file.

Save File



Allows you to save an .NWS formatted file into either the .NEC, ASCII (.TXT) or EZNEC format

Show Formulas



Use this button to show only formulas. Works as a toggle.

Highlight Selected Wire



The Highlight Feature is the reverse of the Select Feature. When the Highlight button is depressed clicking on any wire in the Spreadsheet will highlight the wire back in the Display window.

Check Model



Use this command to validate the model.

Note: See the **Geometry Checker** section in NEC-WIN SYNTH User's Manual for detailed instructions on this feature.

Show Display Window



Opens Display window if necessary and makes it the active window.

Keep window on top



This button is available in both the Display and Spreadsheet windows. When enabled the chosen window will remain on top of the other window. Use this feature when the windows overlap each other and you wish to see certain parts of both windows at the same time.

Select wires for geometry operations



This button will cause all wires in the spreadsheet to be selected.

Delete Last Model

D

Deletes the last model from the spreadsheet.

Command Area**Frequency**

This is where you change the frequency

Wavelength

Indicates the wavelength of the chosen frequency.

Units

NEC-WIN SYNTH allows you the ability to choose meters, millimeters, centimeters, yards, feet, inches and wavelengths as units of measure.

Geometry**Rotate Wires**

The Rotate function enables you to rotate the selected entries button around the x, y, or z-axis.

Move Wires

Moves selected entries along the x, y, or z-axis.

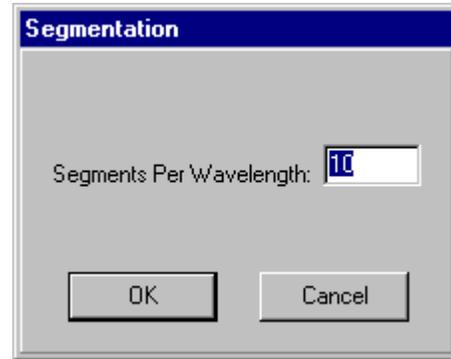
Scale Wires

Scales each wire by a specified scaling factor.

NOTE: See *General Program Notes and Modeling Guidelines* section in NEC-WIN SYNTH User's Manual for detailed information on the use of these commands.

Auto segment selected wires

Allows you to enter how many segments are on each wire by typing the value directly into the combo box. You should highlight the wires you wish to auto-segment before choosing this option.



Spreadsheet In-Line Commands

The following commands are available when right-clicking inside the spreadsheet.

Get Coordinate

Allows you to get the coordinates of a wire or segment endpoint from an existing wire. The obtained coordinates can replace existing coordinates in the spreadsheet or start a new wire.

Within the spreadsheet, place the cursor at the location where you would like to place the new coordinates. This can be an existing wire or a new line. If the cursor is located in columns 1 – 4, the new coordinates will replace X1, Y1, and Z1. If the cursor is in any other column, X2, Y2, and Z2 will be replaced.

After positioning the cursor, click on the Get Coordinate menu option which is accessible from the right click menu on the Spreadsheet. Using the right mouse button, click on different wires within the Display window. As you click, the wire will be highlighted and boxes will be displayed at the segment endpoints. After highlighting the correct wire, press the F1 (function 1) key. Using the right mouse button, click on the appropriate box to have those coordinates placed in the spreadsheet.

***Get Pair of Coordinates***

Allows you to connect a new wire between any two existing wires.

Click on the Get Pair of Coordinates menu option. The Get Pair of Coordinates dialog will appear. Using the right mouse button, click on wires in the Display window. The selected wire will be highlighted with boxes at the segment endpoints. Once the desired wire is highlighted, hit the F1 (function 1) key then click on the appropriate box with the right mouse button. The coordinates for that box will be placed in Coordinate Set 1 of the Get Pair of Coordinates dialog box. Switch to Coordinate Set 2 by clicking the appropriate button or pressing the F3 key. Repeat the above procedure to obtain coordinates for Set 2. Once the coordinates are obtained, click on the Add Wire button in the dialog to have a wire placed between the two sets of coordinates.

It is possible to manually enter coordinate values for Coordinate Set 1 or 2.

Select All

Allows you to select all lines.

Insert Row(s)

Inserts a new row in the spreadsheet.

Deleted Selected Row(s)

Deletes the row or rows selected.

Copy Selected

Copies the area which is highlighted to the clipboard.

Paste Selected

Pastes data from clipboard.

Go to Line

Moves you to the first or last line in the spreadsheet.

ReCalc World Coordinates

This command examines the geometry and resizes the model in the display window to the best resolution to fit the entire model.

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