

# **AIM Quick Start Guide**

Oct 6, 2017

## **LOADING THE SOFTWARE:**

Download the latest AIM program from this website:

[http://www.w5big.com/prog\\_update.htm](http://www.w5big.com/prog_update.htm)

The latest program for the **PowerAIM\_150** is:

[http://www.w5big.com/PA150\\_920B.zip](http://www.w5big.com/PA150_920B.zip)

In the text below, **AIM** applies to the **PowerAIM150** also.

The config file is the same for both analyzers.

The only difference is that when you start to *Calibrate the PA150*, there is a dialog box to select which of the three ranges to use. Each range has its own calibration file.

The AIM program will run with all versions of Windows from **Win2K or later**.

Refer to the document called: **PC\_USB\_INTERFACE-2015.pdf** for more details. This file is included with the zip package that contained the AIM program.

*Some of the screen shots may be different but the basic principles for getting started are the same.*

## **Quick, quick start summary:**

1. Before connecting the AIM, make sure the PC is on the internet.
2. Then connect the AIM to the PC.
3. If you have a conventional RS232 serial port and an AIM4170, AIM4170B or AIM4170C, connect it with a serial cable and use the AIM Setup menu to set the comm port to **1**. *Then skip down to step 8.*
4. If you are using an external USB adapter with an early model of the AIM4170, be sure it employs the FTDI adapter chip.  
This is much more reliable than most other USB chips.  
*The AIM4170D, AIM4300, AIMuhf, VNA2180 and VNAuhf already have the FTDI adapter mounted inside.*
5. If you are using a USB cable, the PC will usually search the internet for the appropriate driver automatically.
6. After the PC finds the USB driver and installs it, it will assign a port number to the AIM. This port number will usually be between 3 and 10.
7. Use the **Windows Device Manager** to find the comm port number or you can experimentally find the comm port by beginning with 3. Close the AIM program and restart it to see if that is the correct number. If not, enter the next higher port number and try it again. The comm port is generally no greater than 10. If it doesn't work yet, use the Device Manager to find the real port number or try another computer.
8. After setting the comm port, use the AIM **Files menu** to load the config file called:

## \_AIM\_config.cfg

9. Now you are ready to calibrate.

The AIMuhf/AIM4300/AIM4170/PowerAIM software does not require a formal installation procedure. It does not interfere with any other programs or the registry on your computer. All the instructions below apply to the AIMuhf, AIM4300, AIM4170 and the PowerAIM.

1) Create a folder or a subfolder on any convenient hard drive. For example, “C:\AntennaAnalyzer”. (the name can be anything)

2) Download the latest program from the website:  
[http://www.w5big.com/prog\\_update.htm](http://www.w5big.com/prog_update.htm)

The latest program is shown at the top of the page. *The AIM4300 which was introduced in July, 2015 requires version AIM\_910 or later. This same version also works with the AIMuhf, AIM4170 and the PowerAIM*

3) Save the zip file in the folder you just created for the antenna analyzer software and documentation. Unzip it in this folder or another folder if you wish.

4) **The file labeled “AIM\_XXX.exe” is the executable file.** It is ready to run without going through an installation process. When later versions of the program are released, the number “\_XXX” will be different. All versions of the antenna analyzer program can reside in the same folder at the same time. The older programs with the lower numbers will not interfere with the newest version, so they do not have to be deleted.

Be sure your computer displays the **extensions of files** so you can distinguish the \*.exe files from the other files. See Appendix 5 for more information.

5) The same program will run the AIMuhf, the AIM4300, the AIM4170 and the **PowerAIM**. It automatically determines which instrument is connected when it starts to run. It is important to turn on the hardware before starting the PC program.

If you want to make a shortcut icon for your desktop, right click on the AIM\_XXX.exe file (or the latest version) and select “create shortcut” from the dropdown menu. Drag the shortcut to your desktop or task bar.

## **HARDWARE CONNECTIONS:**

Plug in the DC power supply (8 to 12V at 500 ma recommended) and insert the connector into the jack on the rear panel of the analyzer.

Press the power switch. The Green LED will blink a few times to indicate the version of software and then remain on continuously. The Red LED is on only when a measurement is in progress.

To turn off the power, press the power switch again. If the analyzer does not receive a command from the PC for 10 minutes, it will power down automatically if it is in the AutoPwrOff mode. The AutoPwrOff mode can be turned on/off with a menu selection under the **Setup** tab at the top of the screen.

The AIM can be operated on battery power for remote operation with a laptop computer. The current required is about 350-400ma while a measurement is in progress and about 50ma when idle.

Batteries are not included with the AIM but you can make a battery pack using any type of batteries you like. There is room *inside the case* for a 9V battery and disconnect diodes are included so the battery and the AC power supply will not interfere with each other. There is also a space for an optional resistor to use for trickle charging a battery, if desired. The main power on/off switch controls the battery power too, so the leakage current is less than one microamp when the AIM is turned off. Refer to Appendix 6 and the Application-Help file for more details

When using the AIM to test a mobile antenna on a motor vehicle, it is better to use a separate battery and **not** the 12V battery in the vehicle. A 9V battery will power the unit for several hours or a small 12V gel cell (sealed lead acid) battery can be used for extended operating periods. This avoids the problem of sneak paths through the ground between the DC power input and the antenna ground connection. It will also help reduce measurement noise if it's necessary to run the engine while taking data (such as to operate the air conditioner). **If it's essential to get power for the AIM from the vehicle, be sure to put 500 ma fuses in BOTH the +12V lead and the power ground lead.** A small voltage drop across the fuses will not affect the AIM since the battery voltage is much more than the required minimum operating voltage. The laptop computer being used should remain **floating** for the best measurement accuracy.

When using the AIM with a new antenna system, check the AC and DC voltage between the antenna ground and the ground used for the AIM and the PC. This voltage should be less than 1V. A balanced antenna should have a DC connection to ground through a balun or RF choke on one side (or both sides). Of course there should always be a large resistor (or balun) connecting both leads of the antenna to a ground path in order to drain off static electricity.

**NOTE: Before connecting a transmission line to the input of the AIM, be sure to momentarily short its pins together to drain off any static charge that may be present. Also, be sure there is no DC voltage on the antenna. If there is DC, use a blocking capacitor between the AIM and the antenna input. The**

blocking cap can be included in the calibration path so its effect will be canceled out and the RF antenna data will still be accurate.

Antennas and transmission lines can have enough static charge to damage sensitive electronic equipment. This can happen even when there is no rainstorm in the area. A strong wind can generate static charge. So can just flexing a coaxial cable by rolling it up or unrolling it, even if there is no antenna connected to it.

An antenna or a component to be measured should not be connected or disconnected from the analyzer while a test is in progress. A test is in progress when the **RED LED** is on.

***Be sure the maximum input voltage at the DC power connector does not exceed 15 volts. The minimum input voltage required is 6.0 volts.***

**NOTE:** Low cost power supplies that plug in the wall are usually not regulated and their maximum output when no load is connected may be several volts higher than their rated output. **Check the output voltage with no load to make sure it does not exceed 15 volts.**

Power supplies that operate on a wide input voltage range such as 120V to 220V use a switching regulator. Evaluate the measurement results to see if noise from the power supply may be a problem.

#### **PC INTERFACE CABLE:**

##### **AIM4170, AIM4170B, AIM4170C and PowerAIM:**

Connect one end of the **RS232 cable** to the antenna analyzer and the other end to COM1 on your PC. If you want to use a different COMM port, start the AIM program and click on the **Setup** menu at the top of the screen. Then click on **Enter Comm Port** and enter the port number that you want to use. This number will be saved in the setup file called *AIM\_XXX.ini*.

**If you are connecting to the RS232 port with a USB adapter, you will need the appropriate driver. An adapter based on the FTDI chip is recommended, especially with Win 7. For additional information on the usb port, refer to this document: [w5big.com/PC\\_USB\\_INTERFACE.pdf](http://w5big.com/PC_USB_INTERFACE.pdf)**

The latest FTDI drivers can be found here: [FTDI Drivers](#)  
The installation guide is here: [FTDI Installation Guide](#)

Refer to the W5BIG.com FAQ page for more tips on setting up the interface:  
<http://www.w5big.com/FAQ.htm>

If you have a USB adapter that you have been using with other equipment, it should be ready to run.

### **AIMuhf , AIM4300, AIM4170D:**

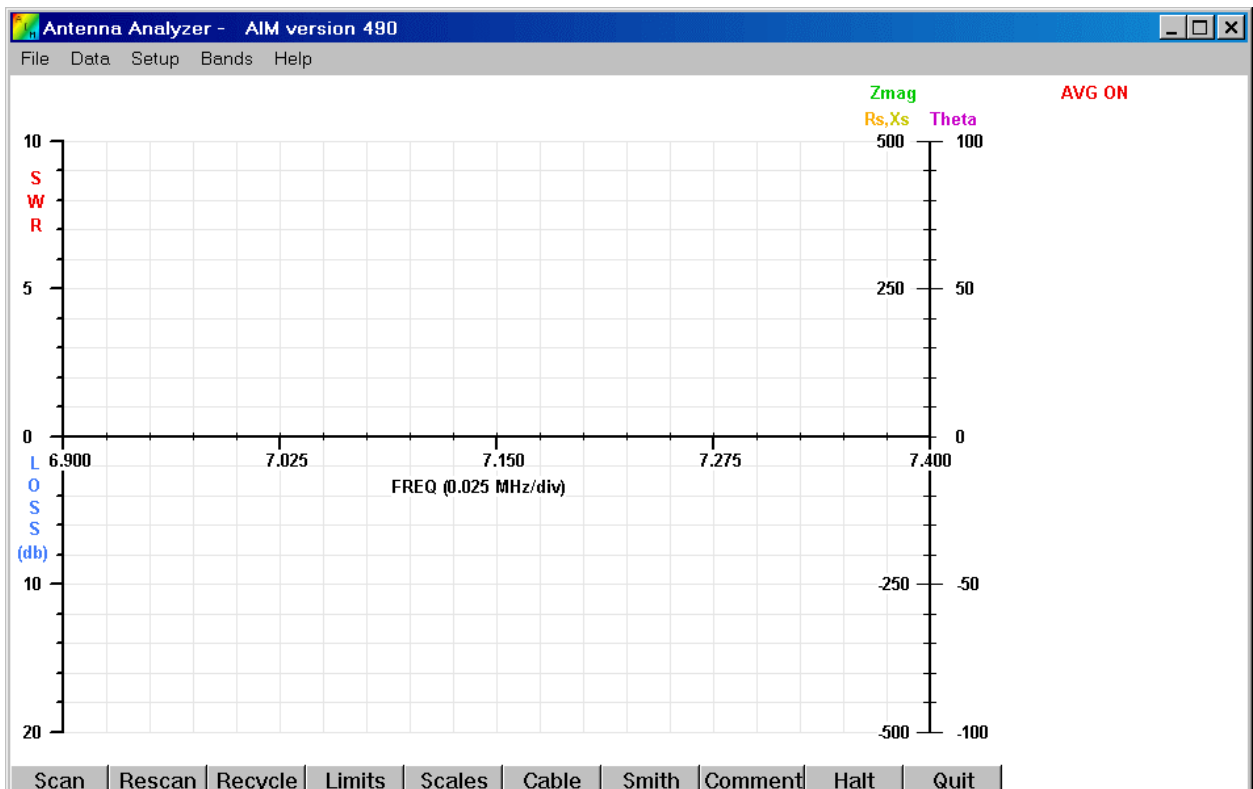
These models include the USB adapter made by FTDI. When the AIM is first connected to the PC, the PC should say "New Hardware Found" and then it will look for the appropriate drivers on the internet.

Be sure the configuration file is loaded:

Click **Files -> Load Config File** and select the file called: **\_AIM\_config.cfg** that is in the same folder with the AIM **exe** file.

### **Initial Operation:**

Launch the AIM\_XXX.exe program. You will see a graph similar to this:

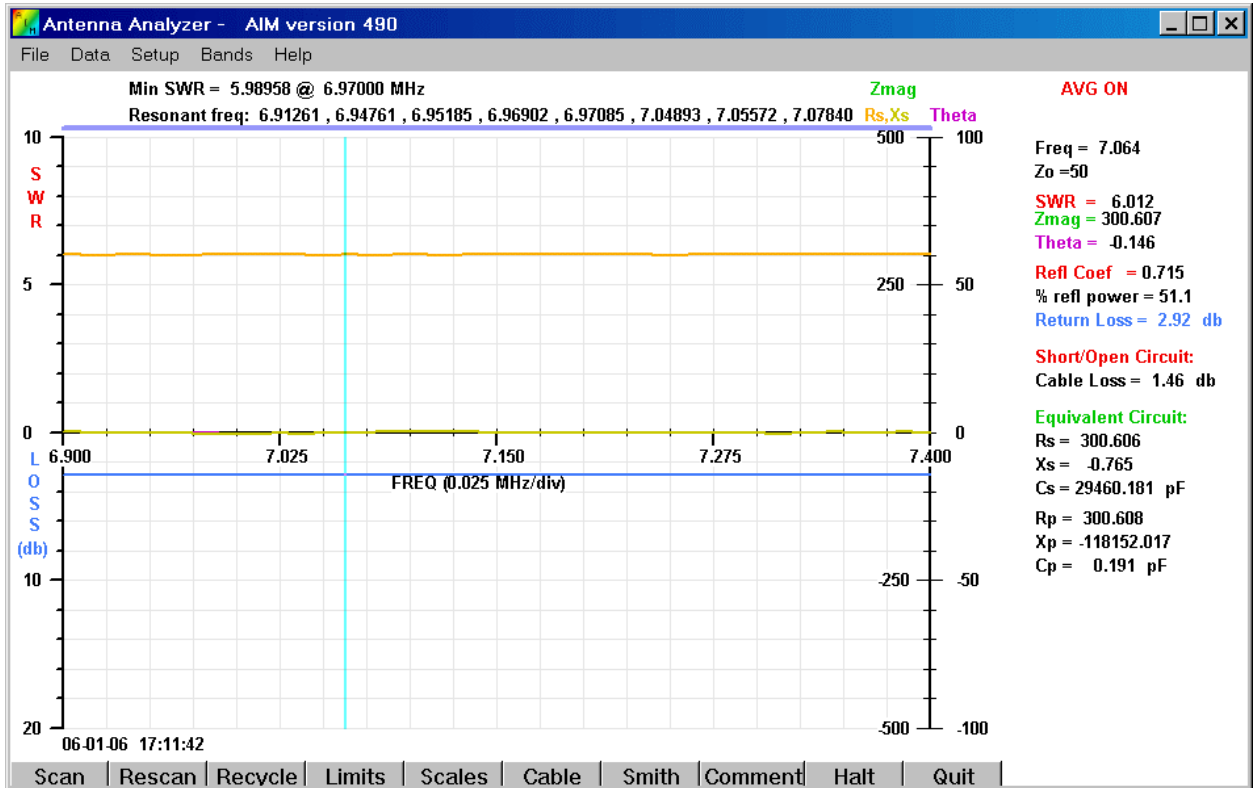


When the AIM hardware is present, it must be turned on **before** the PC program is launched.

If the PC program starts when the AIM is not connected and powered up, the program will automatically enter the DEMO mode. In the demo mode, you can look at previously saved scan files.

The Red LED will come on while the scan is in progress. A blue bar will move across the top of the graph as the scan progresses.

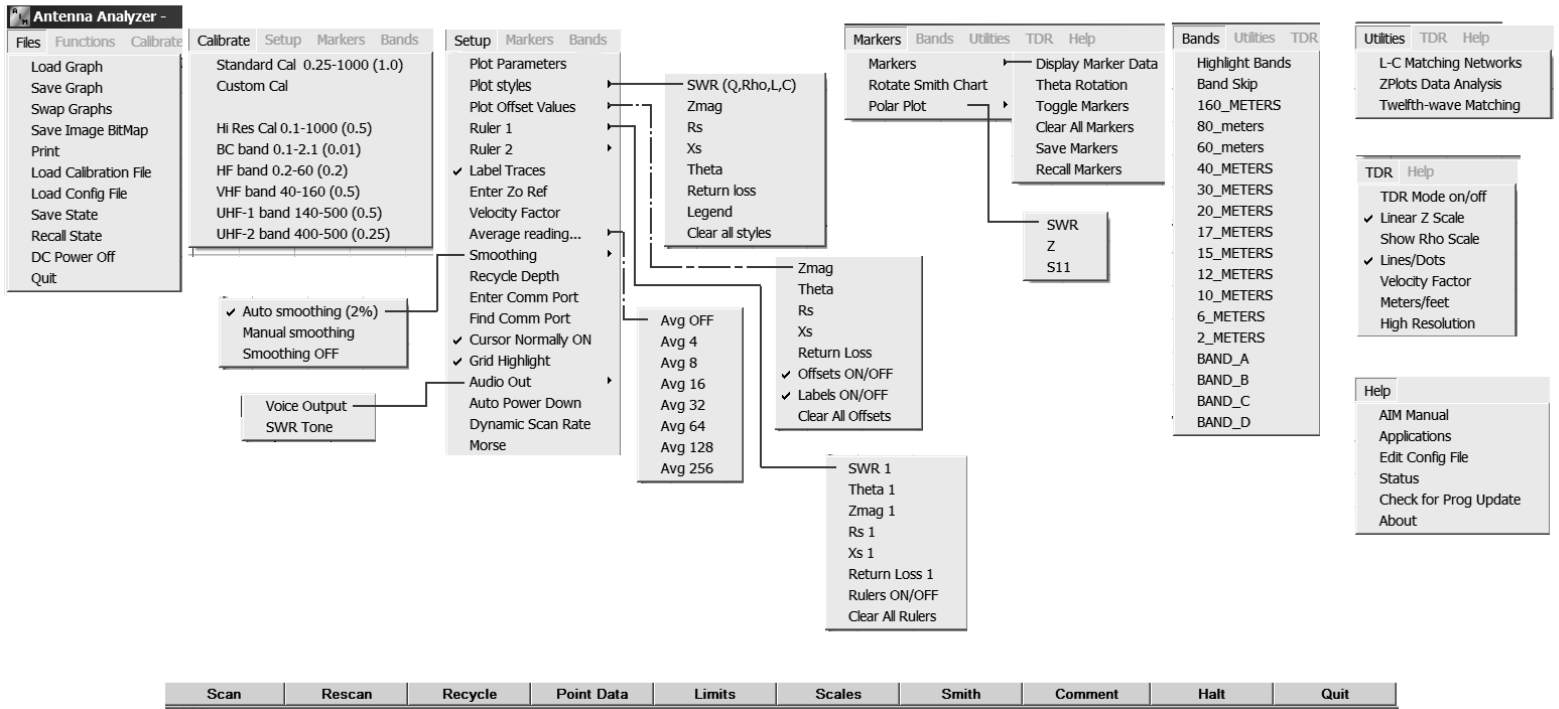
You will see a set of traces (similar to the picture below). The actual values are not important, but this shows the AIM is functioning.



Scan using a 301 ohm resistor for a test load.

MENUS FOR AIM4170/ AIMuhf/ PowerAIM120

Sept 12, 2011 RHC

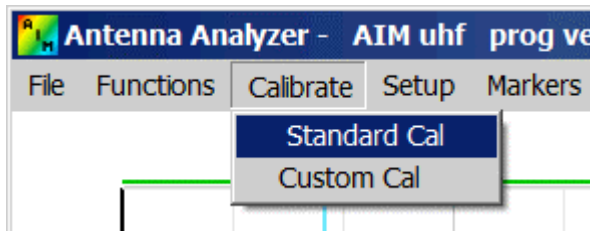


[Larger version of this image:](http://www.w5big.com/AIM_menu.png) [www.w5big.com/AIM\\_menu.png](http://www.w5big.com/AIM_menu.png)

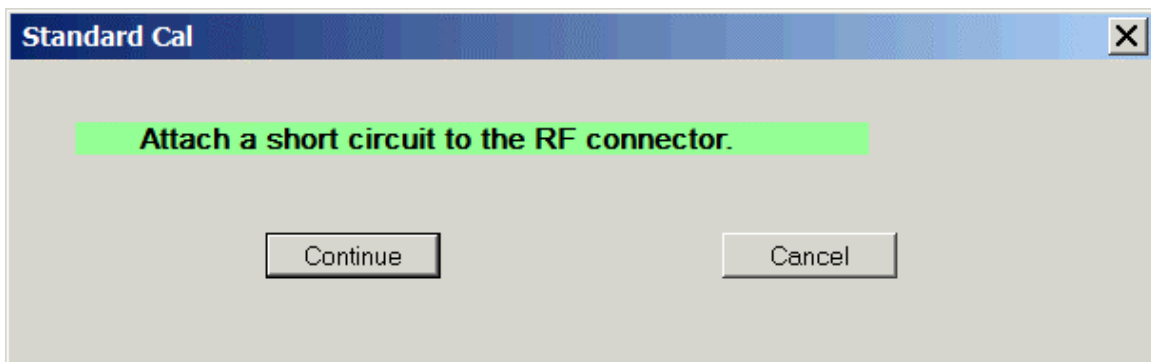
## Calibration

The AIM have **no internal adjustments**. There are no trim pots or caps inside. All the calibration is done with the following software procedure.

Click on the **Calibrate** menu and select **Standard Cal**.



A message box will appear near the center of the screen, as shown below:



Attach the connector with an internal short circuit (this is included with the AIM, it has a green label and is labeled “short”).

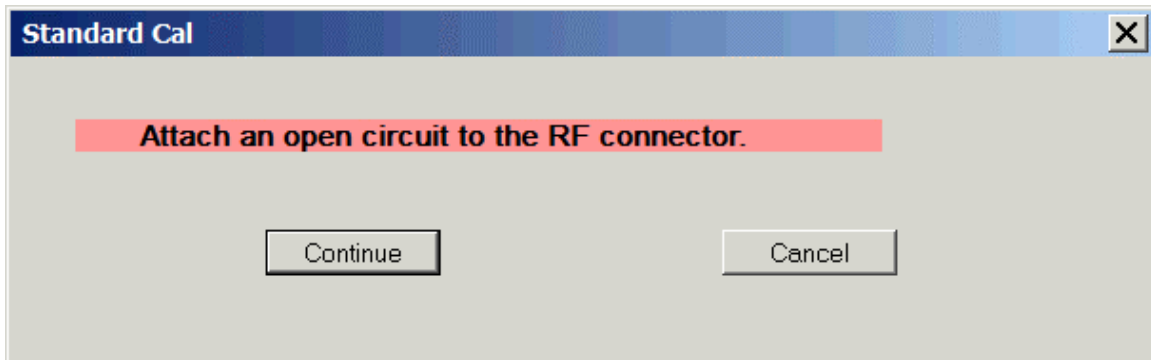
After the short circuit is in place, click **Continue**.

The program will run for a few seconds to take several reading of the **short circuit**.

Sometimes when calibrating with a coax stub or an external filter connected to the AIM RF port, the impedance may appear to be significantly difference from a short circuit at 1MHz and a message will appear asking if this is a valid condition. If the connections are correct and you really do want to continue with the special external hardware hooked up, click YES. Otherwise, click NO to abort the cal procedure. Then after connecting the desired load, restart the calibration.



Then it will display a message box, shown below:



**Replace** the short circuit with an **open connector** (this has a red label and is included with the AIM) and then click **Continue**.

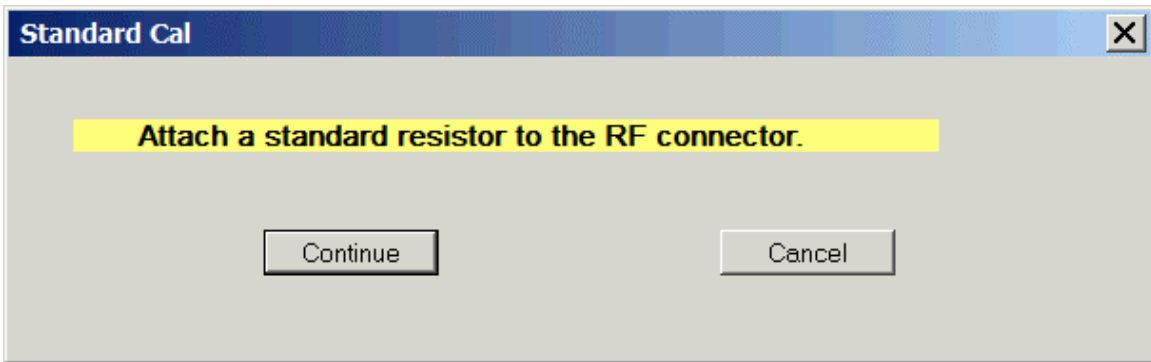
The program will run for a few seconds to take several readings of the **open circuit**.

For the best accuracy, especially at VHF frequencies, use an **open connector** of the same type that is used for the **short circuit**. This allows the program to compensate for the stray capacitance of the connector itself. For example, 3 pF of stray capacitance due to a BNC connector represents a reactance of about 1K ohm at 50MHz which will appear to be in parallel with the load. This will seriously affect readings at higher frequencies if it is not properly compensated. Therefore, the three calibration devices (open, short, resistor) should be carefully constructed so they have similar stray capacitance and inductance which will be cancelled out by the calibration procedure.

*NOTE: If you are using the UHF/BNC adapter (or another adapter) leave it on the output connector of the AIM when calibrating the **open circuit**. In this way, the capacitance of the adapter itself will be included in the calibration process.*

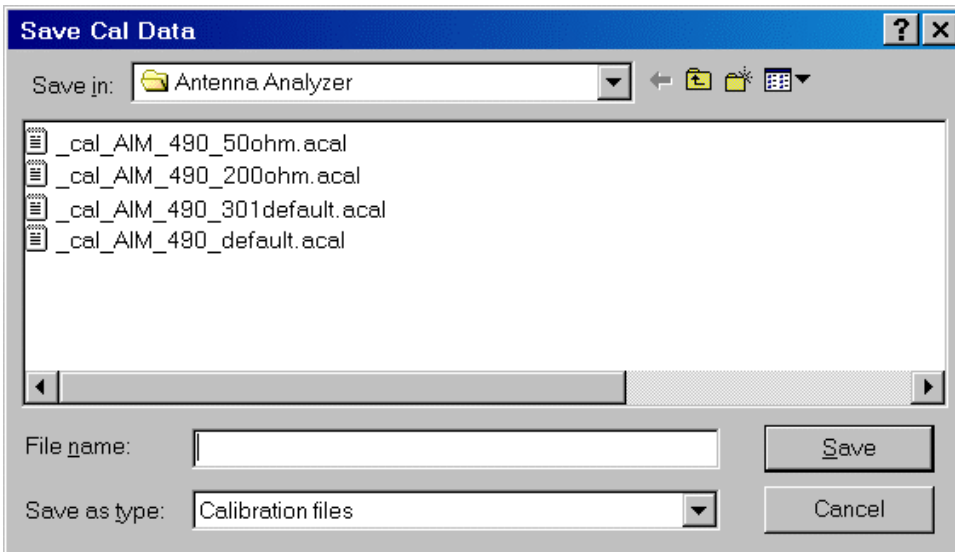
For example, If you want to use a BNC-to-binding post adapter, calibrate the short circuit with a **jumper wire** across the binding posts. Then remove the wire and calibrate the open circuit condition with the adapter still attached. This procedure cancels the stray capacitance of the adapter and you can get accurate readings of discrete components attached to the binding posts.

The calibration procedure can also cancel the effect of a piece of coax that is used as a jumper to connect the AIM to the load. In this case, the open, short and standard resistor are connected to the far end of the jumper. Good results have been obtained with as much as two feet (60 cm) of jumper coax.



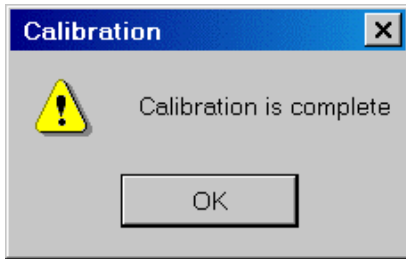
After taking several readings of the open connector, the program will prompt for the standard resistor with a value between 50 ohms and 500 ohms. This resistor typically has a yellow label and is included with the AIM kit. If you want to cal with a different resistor, the exact value is not critical. Enter the value you measured with a digital ohmmeter and click Continue.

After reading the standard resistor, the Red LED goes off and the prompt for a calibration data file name appears:



Enter the name of the calibration file and click "Save". There is no restriction on the name of the cal data file. Its extension is automatically set to .acal ("analyzer cal"). Any of these cal files can be recalled later using the menu option "File" → Load Cal File.

Then the cal complete message box is displayed as shown below:



Click **OK** to continue.

Each time the AIM program starts, the last calibration file that was used will be read to restore the cal data. Any number of calibration files can be saved and recalled using the **Files** menu.

*For a quick test after calibrating, leave the calibration resistor connected to the RF connector and click the **SCAN** button in the lower left corner of the screen. You should see a flat green line corresponding to  $Z_{mag}=50$  ohms and a purple line corresponding to  $Phase = 0$ .*

Since there are no adjustments that have to be made inside the case, the calibration is very stable.

This completes the calibration procedure. Now you are ready to begin testing your antenna.

## Appendix 4 – RS232/USB Operation

Because some newer computers don't have RS232 ports, it may be necessary to use an RS232 to USB adapter with the AIM. The AIM's RS232 port uses only three wires. Pin 2 is the data from the AIM to the computer, pin 3 is the data from the computer to the AIM and pin 5 is ground. Hardware handshaking is not used. The signal amplitude on the I/O lines (pins 2 and 3) is approximately +/-5V.

The comm port assigned to the USB adapter can be found using the Windows Device Manager. In the lower left corner of the Windows desktop, click Start → Settings → Control panel → System → Hardware → Device Manager.

If there seems to be a problem with the USB adapter, here are some tips for checking it.

When the AIM first powers up, it sends out a character string that can be received by any **terminal emulation program**, such as **HyperTerminal**. To use HyperTerminal, which is a standard accessory in Windows, click on the **Start** button in the lower left corner of the Windows desktop. Then, click "Programs" -> "Accessories" -> "Communications" -> "HyperTerminal". Set HyperTerminal for the following parameters:

Baud rate=57600; 8 data bits; 1 stop bit; no parity; echo typed characters locally.

When HyperTerminal is ready, turn on the AIM power. The green LED on the AIM front panel will flash and the text displayed on the computer terminal is the following (or similar):

*Antenna Analyzer AIM  
from Array Solutions  
Oct 13, 2006*

If this is displayed, it means the data from the AIM to the computer is okay.

To check data from the computer to the AIM, type **K1** (**K** and a one). Note the **K** is **upper case**. The command **K1** will cause the AIM to turn on its Red LED. There is **no character space** between the **K** followed by a **1**, but the time interval between typing the **K** and the **1** is not critical. Then, type **K0** (K followed by a zero). The Red LED should go off. This indicates the AIM is able to receive commands from the computer; therefore, the I/O data link is working properly.

revised: Dec 28, 2010

## Appendix 5 – File Extensions

Windows has an option to not display the extensions of some files. This makes it hard to distinguish files with the same names but different extensions. Be sure this option is **not** enabled.

The following images show the dialogs that appear in Win 7. The phrase "Hide extensions for known file types" is used in other versions of windows too.

