
Particle Analysis and Display System (PADS): AIMMS20 Module Manual

**DOC-0269, Revision B-1
PADS 3.5
AIMMS20 Module 3.5.0**



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Instrument computers from DMT are configured to acquire data in a reliable, robust manner. Typically, such instruments are either not connected to a network or are connected to a small, local network that is isolated from the internet, reducing the risk of viruses. Since anti-virus programs can cause erratic behavior when run in the background on data acquisition computers, DMT does not install anti-virus, anti-spam, or anti-malware programs. If you choose to install these programs, you accept the risk associated with them in terms of potential performance degradation of the software installed by DMT.

For similar reasons, DMT recommends that you do not install or run other software on the dedicated instrument computer. Although the installation of some software may be unavoidable, it is particularly important not to run other software while the computer is acquiring data.

CONTENTS

1.0	Introduction	4
2.0	Configuration.....	4
2.1	Configuring the AIMMS20	4
2.1.1	AIMMS20 Parameters.....	5
2.1.2	Channels Table	6
2.2	Configuring the AIMMS20 Display	7
3.0	The AIMMS20 Window	9
3.1	Data Tab	10
3.2	Selectable XY Tab	11
3.3	Selectable Plot and Heading Tab.....	12
3.4	3-D Tracking Plot	13
Appendix A:	AIMMS20 Channels	17
Appendix B:	Changing the Sample Rate in the AIMMS-20 Configuration Manager	18
Appendix C:	Revisions to Manual.....	20

List of Figures

Figure 1:	AIMMS20 Configuration Editor Window	5
Figure 2:	Example Channel Specifications in the Config Editor Window	7
Figure 3:	AIMMS20 Display Editor Window	8
Figure 4:	AIMMS20 Data Tab	10
Figure 5:	Selectable XY Tab-Viewing X Channel Value for Current Time	11
Figure 6:	AIMMS20 Selectable Plot and Heading Tab.....	12
Figure 7:	AIMMS20 3-D Tracking Plot.....	14
Figure 8:	3-D Tracking Plot in “Latitude by Altitude” Mode	15
Figure 9:	Autoscaling Latitude	16
Figure 10:	AIMMS20 Data Cable Connection during Configuration	18
Figure 11:	AIMMS20 Setup Window.....	19
Figure 10:	AIMMS20 Data Cable Connection during Data Acquisition	20

1.0 Introduction

The Particle Analysis and Display System (PADS) is a software package that interfaces with instruments produced by Droplet Measurement Technologies (DMT) and other leading instruments used in the atmospheric sciences. This manual describes the PADS AIMMS20 module version 3.5.0.

For an explanation of the basic PADS setup and instructions on how to acquire data using PADS, consult the *PADS Overview Manual, DOC-0300*. Definitions and calculations used in the AIMMS20 module are also described in the *PADS Overview Manual*.

Note that PADS has an ADP module that displays a subset of the data displayed in the AIMMS20 module. The Air Data Probe (ADP) is a component of the AIMMS20 that can be purchased as a stand-alone instrument. Customers who purchase a stand-alone ADP with PADS receive the ADP module. Both the AIMMS20 and the ADP component are made by [Aventech Research, Inc.](#)

2.0 Configuration

Using PADS, you can configure both the software settings for the instrument and the instrument's data display in PADS. The following two sections explain how to do this. Configuring the instrument's software and display affects the default settings PADS uses when starting up. Some parameters can also be changed while PADS is running, but doing so affects the current session only.

2.1 Configuring the AIMMS20

Your AIMMS20 and data system should arrive preconfigured from DMT. In some cases, however, you may want to change the software configuration for the instrument. To do this, follow the steps below. *Note: Droplet Measurement Technologies STRONGLY recommends that customers contact our office prior to changing any of the parameters in the instrument configuration. Improper changes can result in communication failure and/or changes in PADS computation algorithms, which can compromise data validity.*

1. Click on the “AIMMS20” tab.
2. From the **Configure** menu, select **Configure Instrument**. You will see the following window.

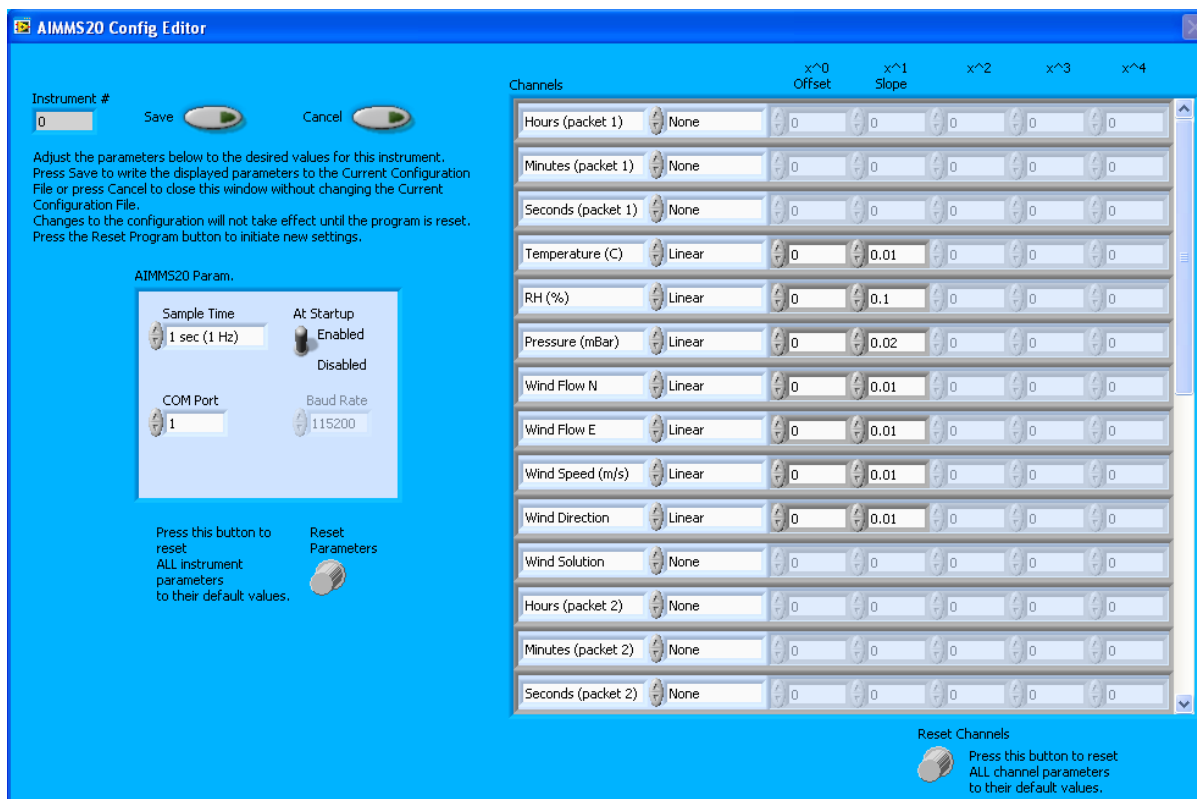


Figure 1: AIMMS20 Configuration Editor Window

3. Now you can configure the instrument parameters to your desired specifications. See the definitions below for explanations of individual parameters. If at any time you would like to revert to the previously saved values for the AIMMS20 parameters, press **Cancel** to exit the window without saving changes. Pressing **Reset Parameters** reverts parameters to their DMT-supplied default values.
4. When you are done configuring the AIMMS20 parameters, press **Save** at the top of the Config editor window. Then press the green **Reset Program** button for the new configuration to take effect. Note that pressing the **Reset Program** button will clear any data currently being displayed.

2.1.1 AIMMS20 Parameters

Instrument #: This lists the number corresponding to the instrument you are viewing, in this case the AIMMS20. If your AIMMS20 has been assigned instrument number one, you will see “1” in this field. You should not need to modify the instrument number, and in fact you are unable to do so from within PADS.

Sample Time: This parameter indicates the time interval at which the AIMMS20 relays sample data. Note that you if you change this parameter, you will also need to change the

sample rate within the AIMMS20 setup utility, as described in Appendix B. Furthermore, you will need to change the **Refresh Time** on the Display Editor (see section 2.2) if you want the display to update at the new sample time.

Note that if the AIMMS-20 is set to one Hertz, the instrument collects some data internally at a shorter interval than one Hertz. Wind speed and direction readings, for instance, are gathered at a rate of five Hertz and then averaged over the past four seconds. For channels that store instantaneous rather than averaged data, such as wind components, PADS displays the most recent data the AIMMS20 has relayed.

At Startup Enabled / Disabled: If you want the AIMMS20 to acquire data when PADS begins sampling, make sure this parameter is in the “Enabled” mode. In some cases, such as if the AIMMS20 is inoperative, you may want to use this control to disable the probe. Disabling the AIMMS20 allows data to transmit from other instruments without interference. Data will still be written to the disabled instrument’s output file, but PADS will write “NaN” to all fields.

COM Port: This is the serial communications port that the AIMMS20 uses to connect with the computer. This number should match the computer hardware configuration for the particular computer you are using. If you are not using multiple computers, this number should not be changed.

Baud Rate: The Baud rate for the probe is defined at manufacture, and PADS prevents you from changing it. The program lists this parameter because some probes can run at different baud rates. So if the hardware is reconfigured, the baud rate may change. In general, a higher baud rate means that the probe can transmit data more quickly to the computer. However, higher baud rates may not work with some computers and can result in unreliable data transmission.

2.1.2 Channels Table

The channels listed in the Channels table are configurable. These are data channels returned by the AIMMS20. The Channels table lists conversion equations PADS applies to these channels, if they exist.

Note: While it is possible to use the Channels table to rename output channels, in most cases your system is preconfigured so that the channels in the table correctly match output from the AIMMS20. While minor rescaling of output channels can improve data accuracy, DMT does not recommend altering your basic channel configuration.

The right-hand fields in the channels table indicate the coefficients to be used in the conversion equation. Figure 2 shows the setup for a hypothetical channel with the second-order polynomial conversion equation, as follows:

$$\text{New_Channel} = 34.01 + 0.061 x + 0.0092 x^2$$

where x is the value returned by the instrument.

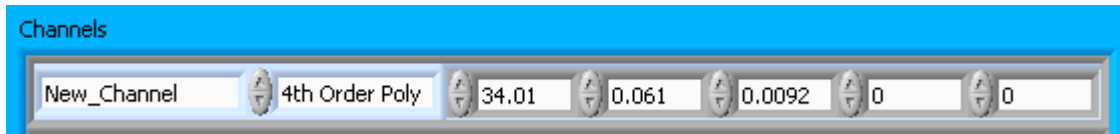


Figure 2: Example Channel Specifications in the Config Editor Window

The number of coefficients that PADS uses depends on the equation type. “None” does not use any coefficients. “Linear” uses the first two coefficients, which are listed in the first two table cells after the equation type. “4th Order Poly” uses one to five coefficients. (“Thermister D” and “Thermister G” are complicated, pre-set equations used by some instruments, while the “Custom” options are reserved for future use. You should not need to select these options.)

In cases where there are non-zero numbers in cells that are not used in the function, PADS ignores these numbers. For instance, if you specify “Linear” as your function and have .32 in the farthest right cell, the program will just ignore this value.

Pressing **Reset Parameters** resets all configuration parameters to their default values.

Pressing **Reset Channels** resets all the channels in the **Channels** table to their default values.

After making changes in the instrument configuration window, you will need to press the **Save** button and then click the green **Reset Program** to activate these changes. Note that clicking **Reset Program** will clear any data PADS is currently displaying.

2.2 Configuring the AIMMS20 Display

To configure the AIMMS20 display, click on the AIMMS20 tab if you have not already done so. Then select **Configure** from the menu bar and click on **Configure Display**. This will bring up the following window.

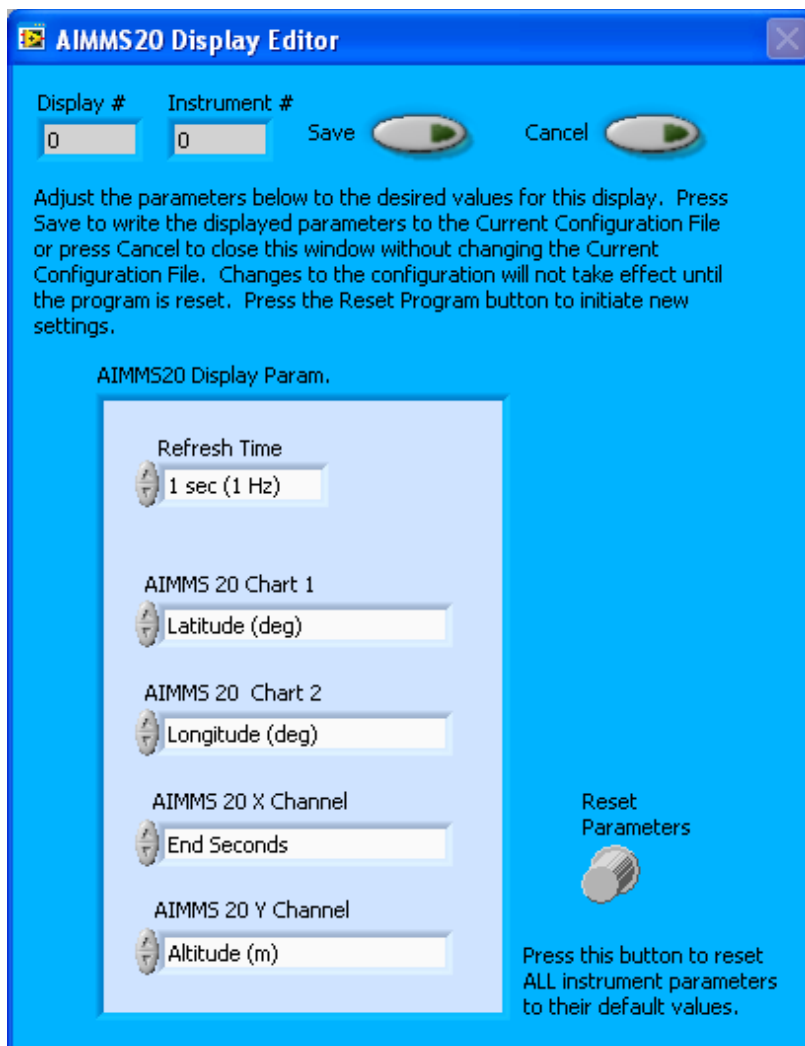


Figure 3: AIMMS20 Display Editor Window

You do not need to modify the **Display #** or **Instrument #**. Changing the **Refresh Time** allows you to set the time intervals for data display during acquisition mode; you can choose any time that is equal to or greater than the sample time. (Choosing a time less than the sample time is not useful, since the same data will be displayed multiple times.)

The AIMMS20 Display Parameter box at the bottom of the window allows you to configure the channels on the AIMMS20's selectable graphs. The first of these charts is located in the **Selectable XY** tab. This graph plots the channel specified as "AIMMS20 X Channel" with respect to the channel specified as "AIMMS20 Y Channel." The two other selectable charts are displayed on the **Selectable Plot and Heading** tab, and they chart the "AIMMS20 Chart 1" and "AIMMS20 Chart 2" channels with respect to time. For information on specific channels and their definitions, consult *Appendix A: AIMMS20 Channels* and the *PADS Overview Manual's Appendix A: Definitions*.

To change the channels in the Display Parameter box, you can click on the arrow buttons to scroll between available options. You can also click on the white fields to bring up a list of all the available channels, from which you can choose the one you want.

Clicking on **Reset Parameters** restores the display parameters to their original default values.

When you are done, click on **Save** to update the configurations or **Cancel** to revert to the previous configurations. After you reset PADS, you will be able to see any changes by clicking on the **AIMMS20 Selectable Charts** tab. Note that clicking **Reset Program** will clear out any data currently being displayed.

Configuring channels in the Configuration Display Editor will change the display upon start-up. Once PADS has started, you can select any channels to be displayed. See the “Selectable Charts” heading under the “Chart Displays” section for more information.

3.0 The AIMMS20 Window

The different parts of the AIMMS20 Window are discussed below.

The **Status** indicator turns bright green when the status indicator is on, as shown in Figure 4. Status is on when all of the following conditions are met:

- 1.) PADS has received data from the AIMMS20.
- 2.) No communications error has been reported.
- 3.) The AIMMS20 has reported a valid wind solution.

A valid wind solution (Wind Solution=1) in turn depends on several conditions:¹

- 1.) The attitude solution is running. The attitude solution provides roll, pitch, heading and inertial velocity components of the aircraft. To generate this data, the AIMMS20 requires valid navigation solutions from both GPS processors and a minimum of four matched satellite pairs.
- 2.) The pitot-static pressure reported from the air-data probe is above a threshold of 200 Pa / 2 mBar (for fixed-wing aircraft), and 50 Pa / .5 mBar (for helicopter setups).
- 3.) The purge-valve sequence is not in effect. (This condition is applicable to canister models that have this option installed.)

¹ Information obtained from Aventech Research Inc., which manufactures the AIMMS20.

When the **Status** indicator is off, data being displayed in the 3-D Tracking Plot may not be current. For more details, see section 3.4.

For explanations of the **Enable** button, **COM Port** indicator, and **Fault/No Fault** button, see the “Instrument Tabs” section of the *PADS Overview Manual*.

The AIMMS20 tab has three sub-tabs, which are described below.

3.1 Data Tab

Figure 4 shows the **Data** tab.



Figure 4: AIMMS20 Data Tab

The Data tab displays commonly used channels. For information on specific channels, their definitions, and their acceptable ranges, consult *Appendix A: AIMMS20 Channels* and the PADS Overview Manual's *Appendix A: Definitions*.

3.2 Selectable XY Tab

The **Selectable XY** tab plots any available channel with respect to any other available channel. Use the fields marked **AIMMS20 Y Channel** and **AIMMS20 X Channel** to specify channels for the graph. You can either click on the text control to the right, which brings up a selectable list of channels, or you can use the button on the left to scroll between channels. Changing the channels from this tab changes them for the current session only; to change the values used upon program start-up, go to **Configure > Configure Display** and select the desired channels.

Data values for the both the X and Y channels for the current moment in time are listed in the gray boxes to the right of the channel controls (Figure 5).

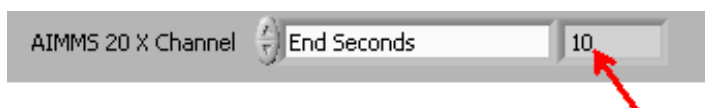



Figure 5: Selectable XY Tab—Viewing X Channel Value for Current Time

Click on the **Plot Properties**  button to access various options for modifying the graph.

On both the x and y axes, you can change the scale by typing a different number into the starting and ending values on each axis. In acquisition mode, you must disable autoscaling (see below) before you modify fields in this way.

Right-clicking on the chart brings up a drop-down menu with various options, e.g.:

Autoscale This autoscales the relevant axis. In autoscaling mode, the minimum and maximum values of the axis are set automatically so that all data points can be seen in the display. Note that on charts that have autoscale buttons, like the large histogram chart on some instrument tabs, the buttons override the Autoscale options in the drop-down menu. To see autoscaling options in the drop-down menu, position the cursor over the relevant axis before right-clicking. Note that you may not always be able to autoscale the x-axis.

Copy Data This copies the chart to the clipboard using a screen capture. This chart can then be pasted into other documents like Word or PowerPoint presentations.

Export Simplified Image This copies a simplified image of the data to the clipboard or an output file. You can choose the format you desire—bitmap (.bmp), encapsulated postscript (.eps), or enhanced metafile (.emf). Note that when you select the .eps option, you must copy the data to a file. Unless you specify otherwise, output files will be saved in the time-and-date-specific output file directory for the current session.

Clear Graph This erases the currently displayed data points from the graph.

3.3 Selectable Plot and Heading Tab

The **Selectable Plot and Heading** tab is shown below.

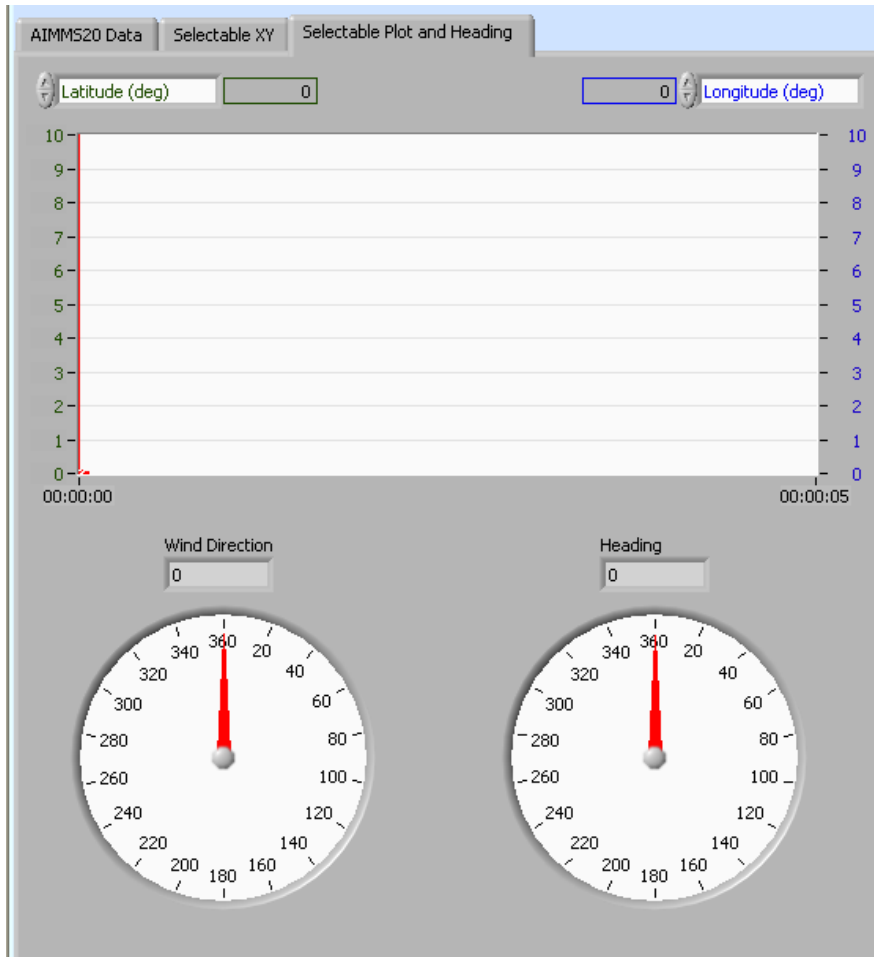


Figure 6: AIMMS20 Selectable Plot and Heading Tab

The top section of the tab displays two overlaid time-series graphs. PADS displays the channels listed in the graph’s left-hand fields in green. The y-axis legends for these

channels are listed on the far left side of the graphs. It displays right-hand fields in blue, and it lists these legends on the far right of the graphs.

To change the channels plotted in the charts, you have two options:

- 1.) To change the charts for the current session only, use the controls in the upper corners of the charts to select the channel you desire. You can either click on the text control to the right, which brings up a selectable list of channels, or you can use the button on the left to scroll between channels.
- 2.) To change the channels shown in the chart's display when PADS starts, go to the **Configure** menu, select **Configure Display**, and choose the desired channels. Then press the **Reset Changes** button to apply this configuration.

When you view charts in playback mode, the currently selected moment in time is indicated by a red cursor. The y-axis value for this time is indicated by cross (+) on this cursor. Y-axis values marked with the cursor are always for channels displayed in green. Note that when you display a large range of time-series data, the chart display does not have sufficient resolution to display each individual time point. To increase resolution, zoom in on the data by changing the time interval to a smaller range.

For information on changing the graph scale and on options for copying, exporting and clearing data, see section 3.2.

The bottom section of the **Selectable Plot and Heading** tab displays two dials. The first shows the wind direction, which is the direction the wind is flowing from (not the direction the wind is flowing *to*). The second shows the direction in which the aircraft is heading. The angle displayed is the angle from true north.

3.4 3-D Tracking Plot

The 3-D tracking plot provides a three-dimensional view of the aircraft's latitude, longitude, and altitude. Figure 7 shows the 3-D tracking plot.

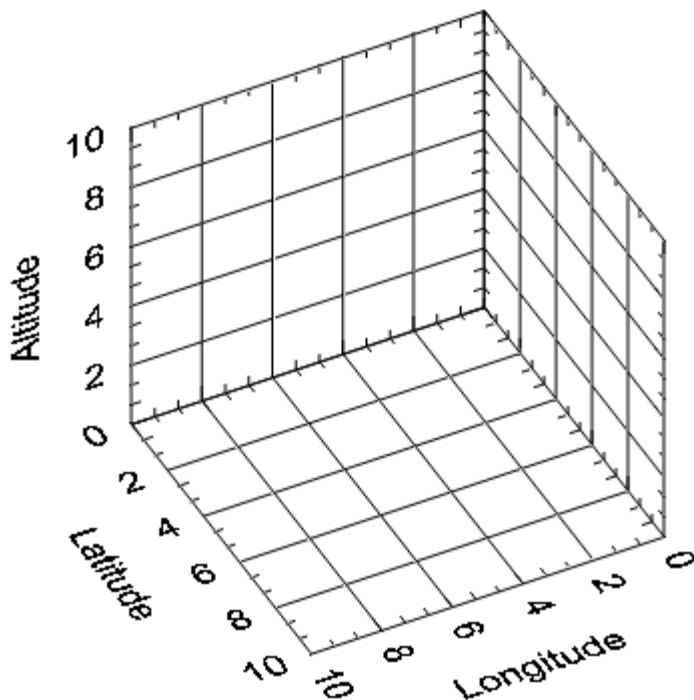


Figure 7: AIMMS20 3-D Tracking Plot

A red dot indicates the aircraft's location. You can rotate the tracking plot in three-dimensional space by clicking on the plot, holding down the mouse, and moving the mouse around. Using the scroll button on your mouse will let you zoom in and out on the plot. If you hold down the shift key and the left mouse button, you can change the plot's position in the window.

The **ViewMode** indicator allows you to modify the tracking plot's display. The default mode is User Defined, which displays the view in three dimensions. **ViewMode**'s other options project the 3D data onto two axes—longitude by latitude, altitude by latitude, or altitude by longitude. Selecting one of these options has the effect of temporarily “collapsing” the omitted axis as if you were looking at cubical space head-on. For instance, displaying the same data as shown in Figure 7 in “Alt x Lat” mode collapses the y-axis, longitude, as shown in Figure 8.

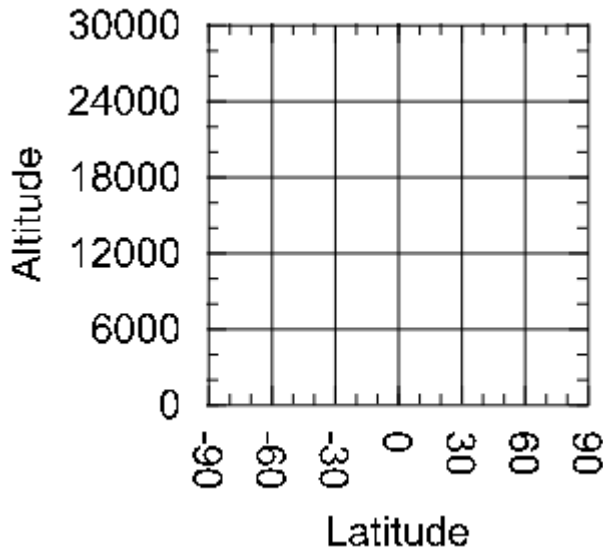


Figure 8: 3-D Tracking Plot in “Latitude by Altitude” Mode

When you rotate the display, however, the view returns to three dimensions.

Occasionally a problem with the AIMMS20 data feed results in erroneous and extremely high or low readings for altitude, latitude or longitude. This problem usually only lasts for one sampling instance, but it can corrupt the 3-D tracking plot by altering the plot’s scale and the aircraft’s position. In order to circumvent this problem, PADS tests the current data. If it detects an erroneous reading, it turns the **Status** indicator off and displays the previous sampling instance’s data. PADS only reuses data this way for ten samples, however; if the program detects more than 10 erroneous readings in a row, it inserts “NaN” (not a number) for all the AIMMS20 data channels. The 3-D plot omits NaN data from its display, so in this case the track will appear to have gaps. The erroneous data will not cause the plot axes to rescale inappropriately, however. During the time that older data are being recycled, PADS sets the **Status** output channel to $[-1] * [\text{the number of samples old data have been reused}]$. E.g., a Status value of -5 indicates old data have been recycled for the previous five samples. Once PADS starts writing “NaN” to the output channels, Status stays at -10.

The **Scale Controls** for the 3-D Tracking Plot (Figure 9) appear in the bottom right of the window.

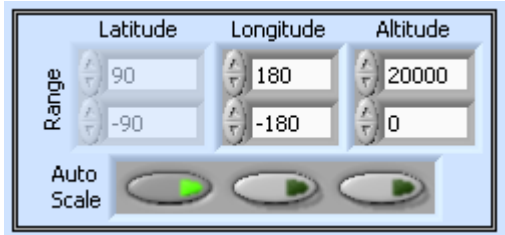


Figure 9: Autoscaling Latitude

To enable autoscaling, click on the autoscale button if it is not currently on. It will illuminate (see the Latitude autoscale button in Figure 9), and the controls above the autoscale button will be disabled.

If autoscaling is not enabled, two controls appear above the autoscale button. These allow you to enter the minimum and maximum values for the scale—latitude and longitude in degrees, and altitude in meters.

Appendix A: AIMMS20 Channels

A complete list of AIMMS20 data channels appears below. The AIMMS20 output file will contain data values for each channel for each sampling instance. You can also plot each of these channels against time using the AIMMS20 Selectable Charts tab.

For definitions of the channels, see *Appendix A* in the *PADS Overview Manual*.

The AIMMS20 relays two data packets of information for each sampling instance. The channels in bold below are sent in the first data packet, which mostly contains information on wind conditions. Channels in italics are ones that the AIMMS20 sends in the second packet.

End Seconds	<i>Seconds (packet 2)</i>
Day of Year	<i>Latitude (deg)</i>
Year	<i>Longitude (deg)</i>
Status	<i>Altitude (m)</i>
Hours (packet 1)	<i>Velocity N (m/s)</i>
Minutes (packet 1)	<i>Velocity E (m/s)</i>
Seconds (packet 1)	<i>Velocity D (m/s)</i>
Temperature (C)	<i>Roll</i>
RH (%)	<i>Pitch</i>
Pressure (mBar)	<i>Yaw</i>
Wind Flow N	<i>TAS (m/s)</i>
Wind Flow E	<i>Vertical Wind (m/s)</i>
Wind Speed (m/s)	<i>Sideslip Angle</i>
Wind Direction (deg)	<i>AOA pres diff</i>
Wind Solution	<i>Sideslip Diff</i>
<i>Hours (packet 2)</i>	<i>Spare 1-8</i>
<i>Minutes (packet 2)</i>	<i>GPS Time / UTC Time</i>

AIMMS20 channels fall into several broad categories:

- Time channels
- Wind and ambient data conditions channels (e.g., Temperature and RH%)
- Aircraft data channels (e.g., Latitude, Longitude, Velocity, Pitch)
- Unused channels (Spare 1 - 8)
- Other (Status)

Appendix B: Changing the Sample Rate in the AIMMS-20 Configuration Manager

By default, the AIMMS20 is configured to sample at a rate of 1 sec / 1 Hz. You can select other sample rates from within the PADS Configuration Editor; see the **Sample Time** entry in section 2.1.1. However, if you do this, you will also need to reconfigure the AIMMS20 to match this sample rate. To do this, follow the steps below.

- 1.) Make sure the AIMMS20 is turned on.
- 2.) Connect the computer's AIMMS20 cable to the black configuration connector (Figure 10).



Figure 10: AIMMS20 Data Cable Connection during Configuration

- 3.) Select `Start > All Programs > aimcfg150`. This will bring up the AIMMS20 Setup Utility.
- 4.) Click on **Setup**, which will bring up the window in Figure 11.

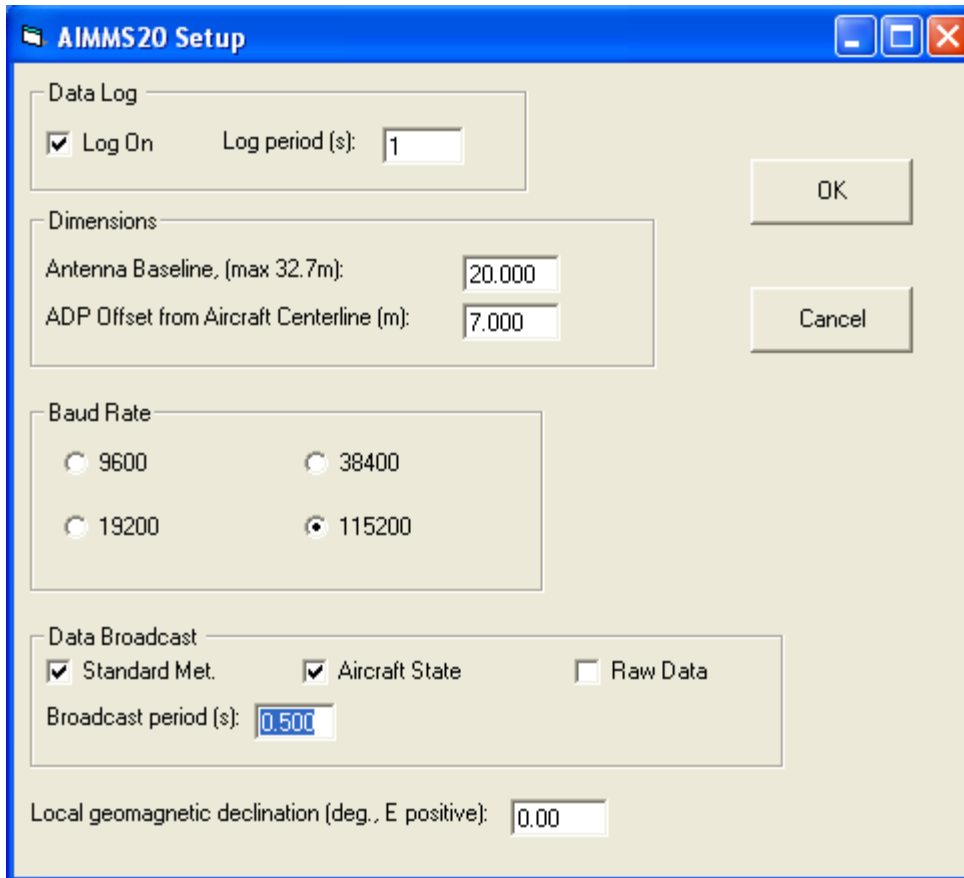


Figure 11: AIMMS20 Setup Window

- 5.) Change the **Broadcast period** to the desired sample time in seconds. For instance, Figure 11 shows the broadcast period set to .5 sec / 2 Hz.
- 6.) Click **OK**.
- 7.) Close the AIMMS20 Setup Utility (click on **File > Exit**).
- 8.) Switch the data cables back to their original configuration, so the white **AIMMS20** cable is connected to the computer's **AIMMS Data Out** cable.

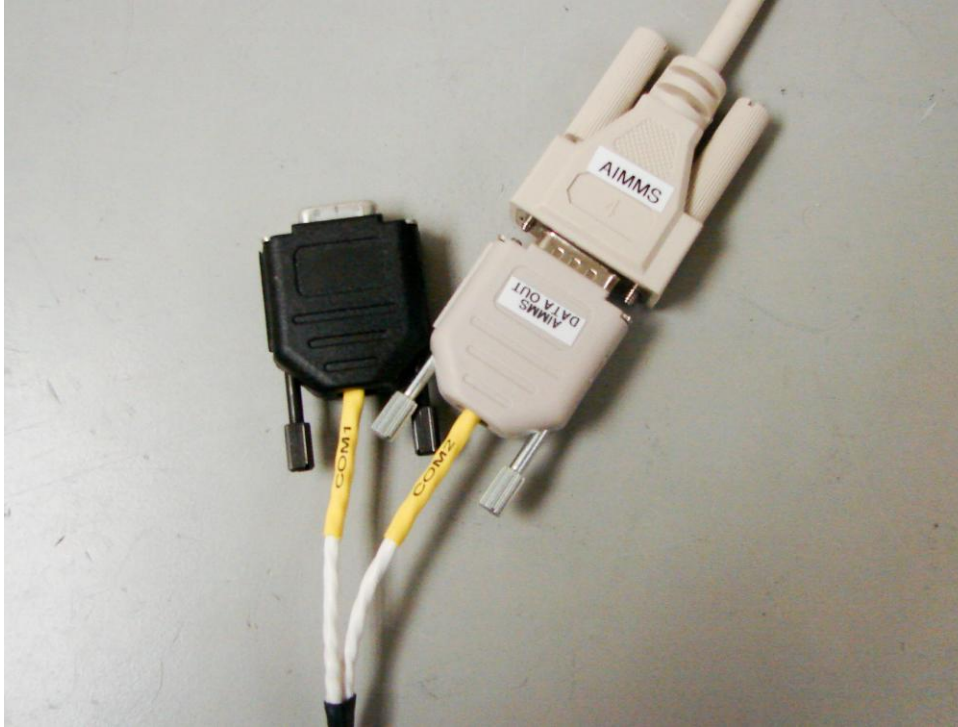


Figure 12: AIMMS20 Data Cable Connection during Data Acquisition

9.) Proceed with data collection.

Appendix C: Revisions to Manual

Rev. Date	Rev No.	Summary	Section
2-4-11	B	Added instructions on configuring sample time in AIMMS20 Setup Utility.	Appendix B
4-7-11	B-1	Updated List of Figures and Figure 9	Frontmatter, 3.4

This document replaces DOC-0185, the *AIMMS20 PADS Operator Manual* for PADS version 2.X.