Particle Analysis and Display System (PADS):

Garmin GPS Module

Operator Manual

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PADS 2.5.6, Garmin GPS 2.5.2

DROPLET MEASUREMENT TECHNOLOGIES

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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 module for the Garmin GPS.

For an explanation of the basic PADS setup and instructions on how to acquire data using PADS, consult the *PADS Operator Manual*. Definitions and calculations used in the Garmin GPS module are also described in the *PADS Operator Manual*.

2.0 Configuration

Using PADS, you can configure both the software for the instrument and the instrument's data display in PADS. The following two sections explain how to do this.

Configuring the Garmin GPS

Your Garmin GPS 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 "Garmin GPS" tab.
2. From the **Configure** menu, select **Configure Instrument.** You will see the following window.

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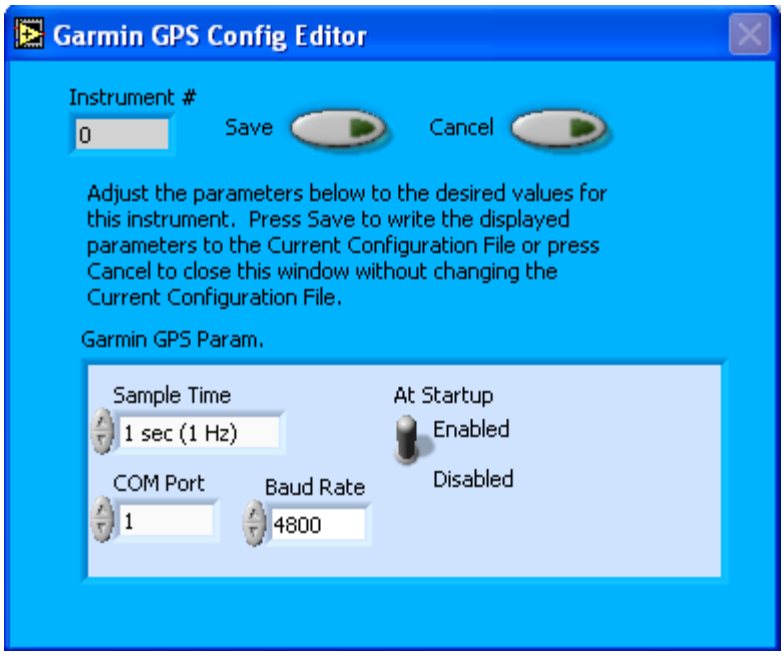

Figure 1: Garmin GPS Configuration Editor Window.

3. Now you can configure the instrument parameters to your desired specifications. You will find a list of the parameters you may want to reconfigure in the two sections below, "Occasionally Reconfigured Garmin GPS Parameters" and "Rarely Reconfigured Garmin GPS Parameters." If at any time you would like to revert to the previously saved values for the Garmin GPS parameters, press **Cancel** to exit the window without saving changes.

4. When you are done configuring the Garmin GPS parameters, press **Save** at the top of the Config editor window. (If you would instead like to revert to the previously saved values, click **Cancel**.) 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.

Occasionally Reconfigured Garmin GPS Parameters

At Startup Enabled / Disabled: If you want the Garmin GPS to acquire data when PADS begins sampling, make sure this parameter is in the "Enabled" mode. In some cases, such as if the Garmin GPS is inoperative, you may want to use this control to disable the probe. Disabling the Garmin GPS allows data to transmit from other instruments without interference.

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COM Port: This is the serial communications port that the Garmin GPS 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.

You will notice that there are other parameters listed on the **Garmin GPS Config Editor** window. Most of these you should not need to change, and changing them inadvertently may compromise your data. If you are curious about these parameters or think you do need to modify them, see the section titled "Rarely Reconfigured Garmin GPS Parameters" below or consult with a DMT technical representative.

Rarely Reconfigured Garmin GPS Parameters

The Garmin GPS configuration editor displays several parameters that you will rarely need to modify. The following is a list of these parameters and an explanation of what they do.

Instrument #: This lists the number corresponding to the instrument you are viewing, in this case the Garmin GPS. If your Garmin GPS 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 shows the time interval at which the Garmin GPS relays sample data. It should always be set to 1 second.

Baud Rate: This parameter stores the baud rate for the probe. Although it is possible to change the Garmin baud rate by using utility software supplied by Garmin, these units are configured to a standard baud rate which should not need to be changed.

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. Clicking **Reset Program** will clear any data PADS is currently displaying.

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Configuring the Garmin GPS Display

To configure the Garmin GPS display, go to the **Configure** menu from the Garmin GPS tab and select **Configure Display.** This will bring up the following window.

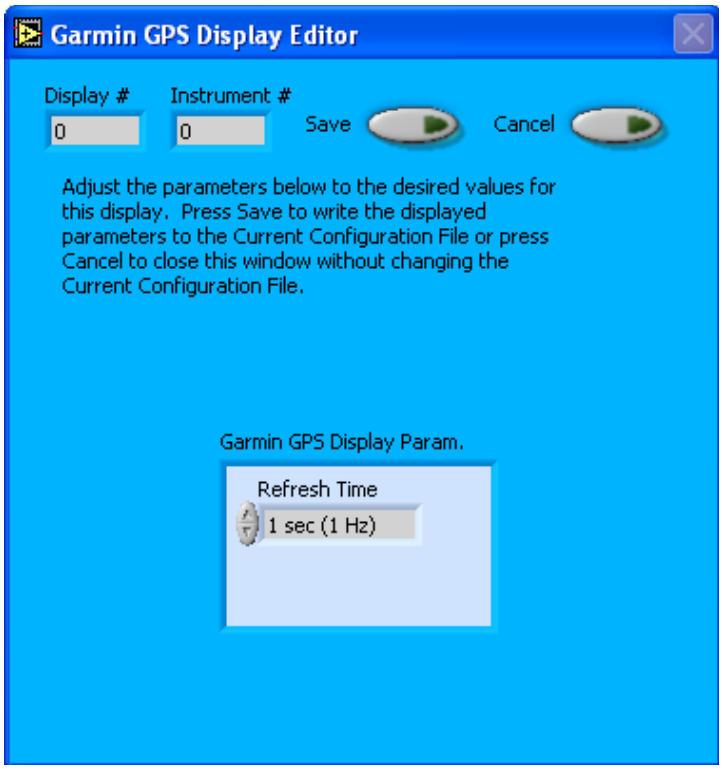

Figure 2: Garmin GPS Display Editor Window

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.)

When you are done, click on **Save** to update the configurations or **Cancel** to revert to the previous configuration. After you reset PADS, you will be able to see any changes you have made to Refresh Time. Note that clicking **Reset Program** will clear out any data currently being displayed.

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3.0 The Garmin GPS Window

The different parts of the Garmin GPS Window are discussed below. For explanations of the **Enable** button, **COM Port** indicator, and **Fault/No Fault** button, see the "Instrument Tabs" section of the *PADS Operator Manual*.

The **Instrument #** and **Display #** fields on the left side of the screen display the instrument and display numbers. Do not change these numbers, as the new values will be ignored.

The **3D Plot Color** control allows you to choose the color for the historical data displayed in the 3D plot. In Figure 3, for instance, the 3D Plot Color is blue. If you click on the colored square beneath the "3D Plot Color" label, you will see a variety of color choices. Clicking on a color will select it as the 3D Plot Color. You can also click on the palette icon to see additional colors or specify colors using R-G-B values.

3-D Tracking Plot

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

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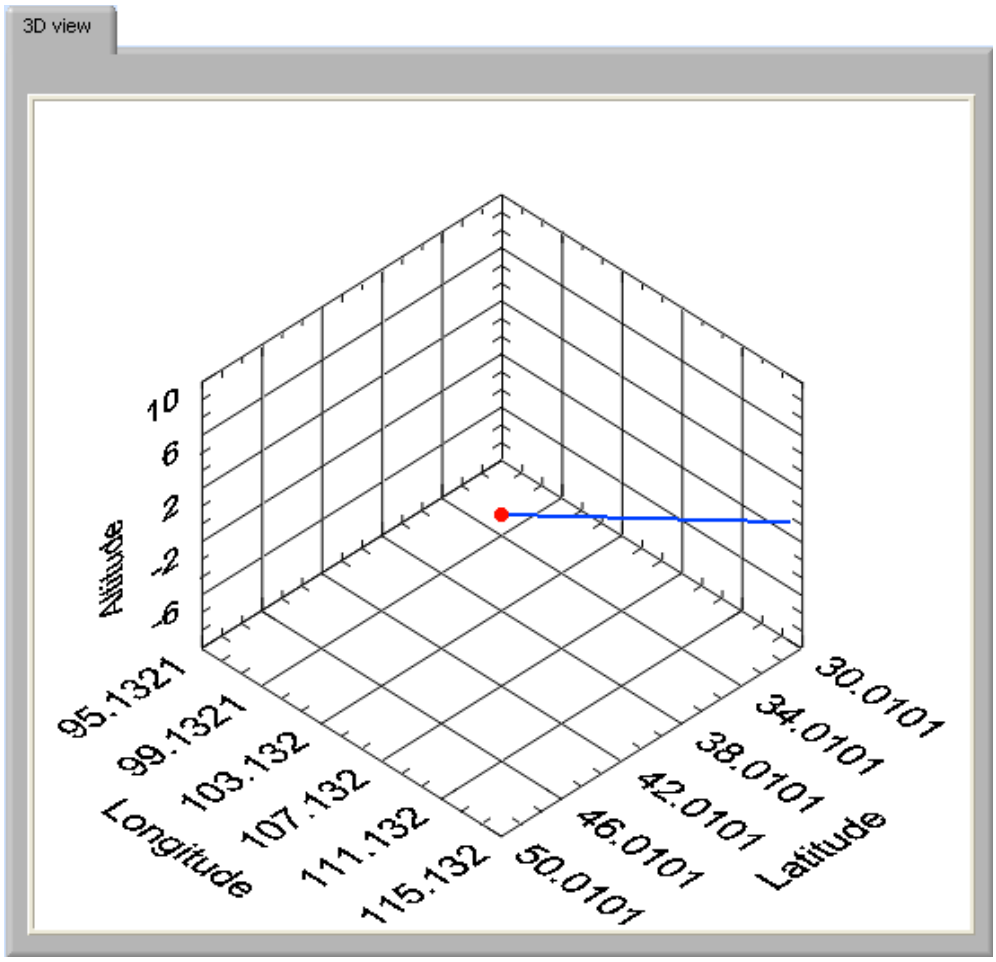

Figure 3: Garmin GPS 3-D Tracking Plot

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 zooms 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.

To the bottom right of the 3D tracking plot are controls that allow you to configure the display. The **ViewMode** indicator allows you to modify the tracking plot's display. The default mode is cwViewUserDefined, which displays the view in three dimensions. **ViewMode**'s other options project the 3D data onto two axes—X and Y, X and Z, or Y and Z. 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 3 in cwViewXZPlane mode collapses the y-axis, longitude, as shown in Figure 4.

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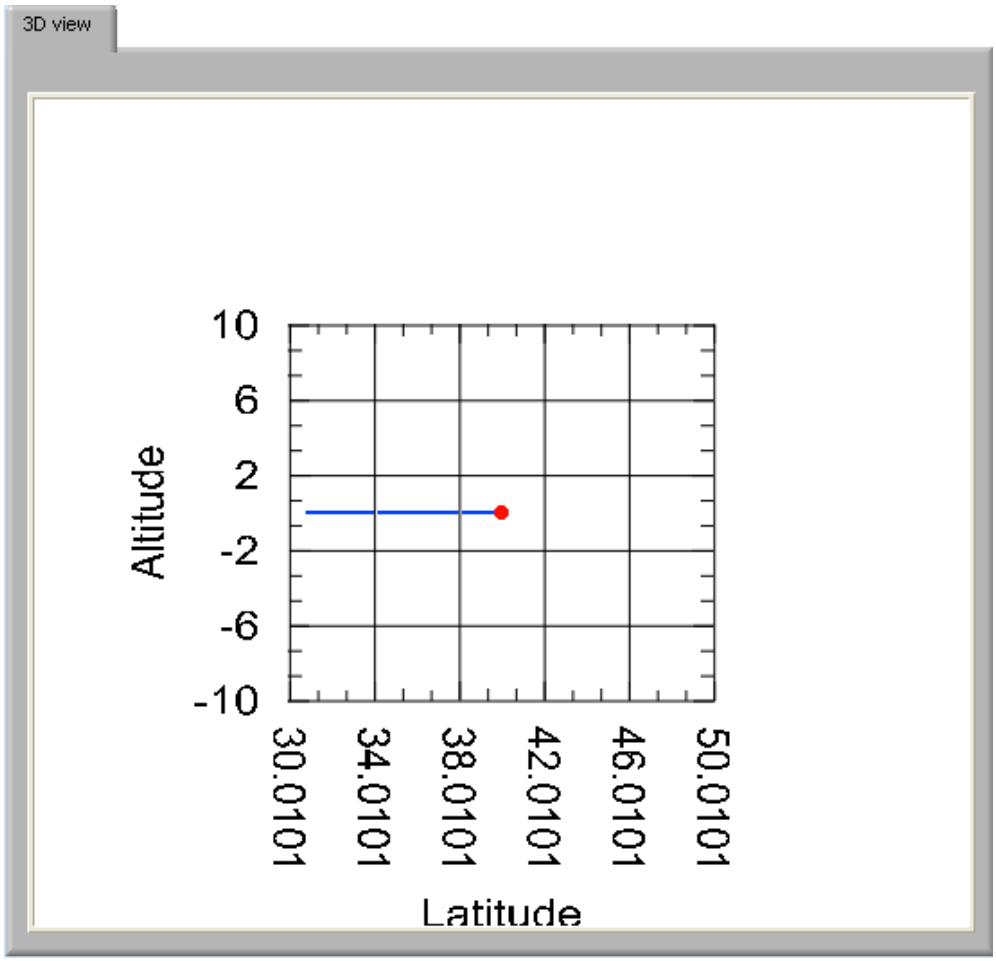

Figure 4: 3-D Tracking Plot in cwViewXZPlane Mode

When you rotate the display, the view returns to three dimensions. In playback mode, you will need to change the sample time before PADS updates the display with a new ViewMode.

The autoscale buttons autoscale the data in the dimension specified. By default, autoscaling is enabled. You can disable it by clicking on the "on" autoscale button so it says "off."

The **Threshold** fields next to the autoscale buttons allow you to expand the scale generated by autoscaling. For example, if you have a latitude of 12° and a threshold of 10, the latitude scale will range from 2 - 22° (12°± 10°). Similarly, if you have an altitude of 16,000 m and an altitude threshold of 2,000, the altitude range will be 14,000 – 18,000 m. (Note that PADS often does not display the minimum altitude, since the label would overlap with the minimum longitude.) You can think of the thresholds as buffers that the system adds to instantaneous latitude, longitude, and altitude readings to obtain an appropriate scale.

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Note that if Status = 0, indicating that current and valid data are not available, PADS will recycle the most recent valid data until new readings become available. This is done to ensure a proper scale for the 3-D tracking plot.

Channel Data

To the right of the 3D tracking plot are the channel data, as shown in Figure 5.

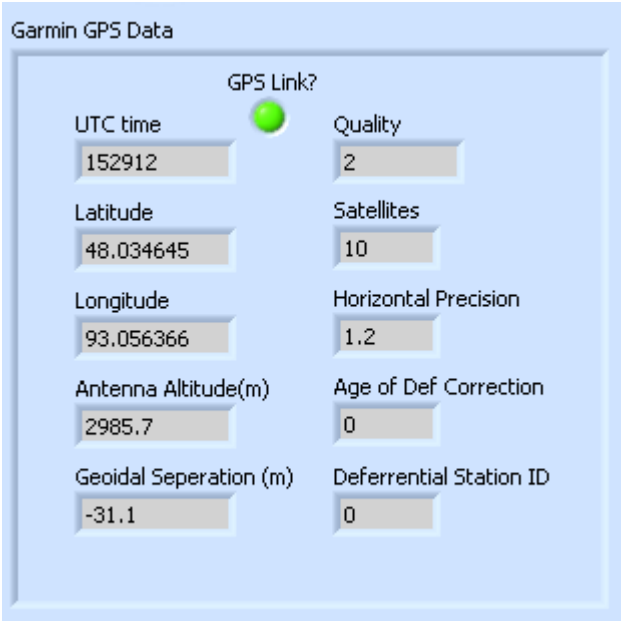

Figure 5: Garmin GPS Channel Data

The **GPS Link?** light indicates whether a successful GPS fix has been made. The light will be on when the GPS link is successful, meaning that at least one satellite is visible. Beneath the **GPS Link?** indicator are the channel data for the current time. Definitions for these channels appear in *Appendix A* of the *PADS Operator Manual*.

As with the 3-D tracking plot, PADS will recycle the most recent valid data if current data are not available. Status = 0 indicates that no valid current data are available and PADS is recycling data.

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Appendix A: Garmin GPS Channels

For each sampling instance, the Garmin GPS will return the channels listed below. Definitions for these channels are given in *Appendix A: Definitions* in the *PADS Operator Manual*.

Time
GPS UTC time
Latitude
Longitude
Quality
satellites
horiz precision
Antenna altitude(m)
Geoidal separation(m)
age of diff correction
differ station ID
Checksum
Status

Garmin GPS channels fall into several broad categories:

Time Channels: The time channels store time data. Time is generated by the PADS computer clock and is the time when the program receives the Garmin GPS data. It is given in seconds after midnight on the day the program was started. GPS UTC Time lists the Coordinated Universal time of the GPS fix. This channel will be included in other system instruments' output files under the name "GPS Time." The channel called Age of Diff Correction (s) lists the number of seconds since the last GPS data transmission occurred.

GPS Data: Antenna altitude, geoidal separation, latitude, and longitude store global positioning data.

Communications Data: Differ station ID, Horiz precision, quality, satellites, and status store information about the communication between 1.) the GPS and satellites or 2.) the GPS and PADS.

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