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

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PADS 3.7.1, Combo Module 3.7.0



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Risks of Installing Additional Software

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.

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1.0 Introduction

The Particle Analysis and Display System (PADS) is a software package that interfaces with all the instruments produced by Droplet Measurement Technologies (DMT) and other leading instruments used in the atmospheric sciences. This manual describes the PADS module for the Combination Probe (Combo) module, which allows you to view and analyze data from the several component instruments simultaneously.

For an explanation of the basic PADS setup and instructions on how to acquire data using PADS, consult DOC-0300, the *PADS Overview Manual*. The *Overview Manual* also gives definitions for all the channels that the Combo module displays.

2.0 Configuration

You can configure the Combo module setup as described in section 2.1. Section 2.2 explains how to configure the Combo display in PADS so that it shows you data in the desired formats.

2.1 Configuring the Combo Module

To configure the Combo Module setup, follow the steps below. *Note: Droplet Measurement Technologies STRONGLY recommends 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 “Combo” tab.
2. From the **Configure** menu, select **Configure Instrument**. You will see the following window.

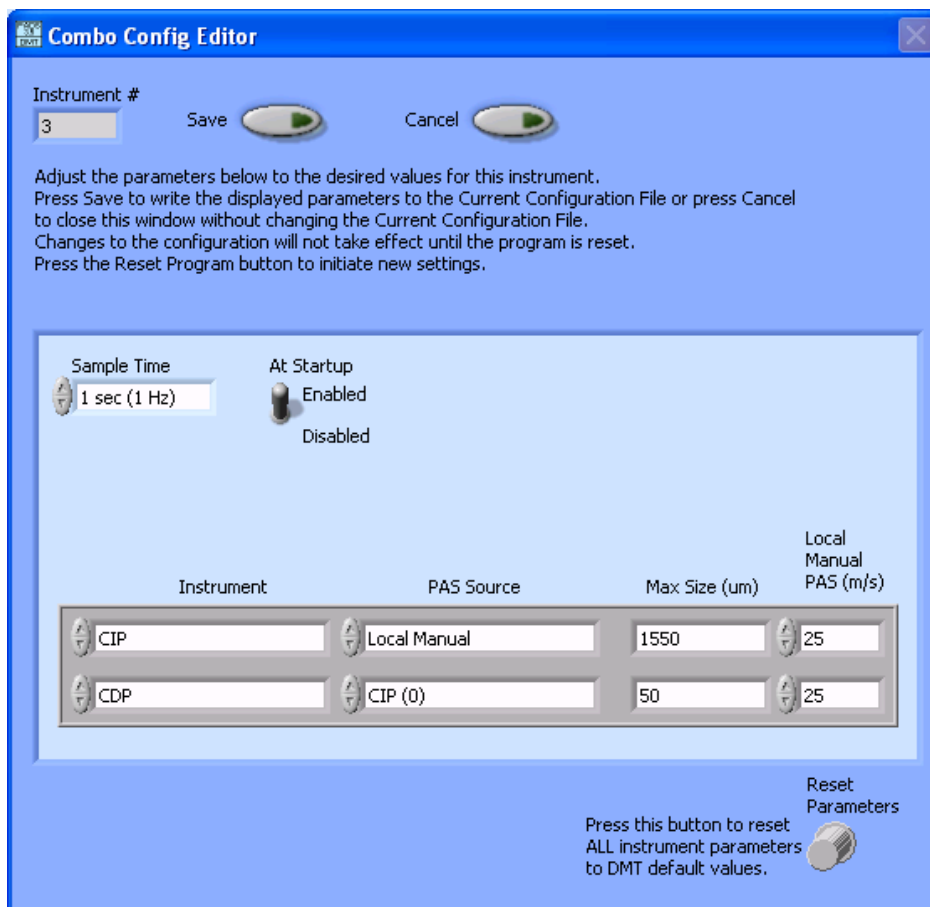


Figure 1: Combo Configuration Editor Window

- 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 Combo parameters, press **Cancel** to exit the window without saving changes. Pressing **Reset Parameters** reverts parameters to their DMT-supplied default values.
- When you are done configuring the Combo 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 Combo Parameters

Sample Time: This parameter shows the time interval at which the Combo module collects data from its component instruments. You can have the probe sample at intervals between 0.04 and 20 sec (25 to 0.05 Hz). It is recommended that you set **Sample Time** to the fastest sample time among the component instruments, so that no data are lost. If the component instruments have different sample times and the Combo sample rate is faster than that of the slower instruments, the Combo module will simply read the latest available data.

At Startup Enabled / Disabled: If you want the Combo module to acquire data when PADS begins sampling, make sure this parameter is in the “Enabled” mode. In some cases, such as if one or more of the component instruments is inoperative, you may want to use this control to disable the Combo module. Doing so allows data to transmit from instruments without interference.

The lower half of the Combo Config Editor window contains a table that allows the user to configure the following parameters for each instrument in the system:

- Probe Air Speed (PAS) source:
- Max Size (μm)
- Local Manual Probe Air Speed (PAS, in m/s)

More information about each of these parameters is given below.

PAS Source specifies from which of the following sources the system should obtain the applied probe air speed (PAS):

- 1.) A specific instrument in the system (this can be any instrument capable of measuring air speed)
- 2.) A “Global Manual” value entered on the **Setup** tab
- 3.) A “Local Manual” value entered in the **Local Manual PAS (m/s)** field on the Combo Config Editor.

Applied PAS is used to calculate sample volume. In flight conditions, you will typically want to select an instrument as the air speed source. However, you will need to enter manual air speed values during probe calibration.

PAS Source affects LWC and Number Conc channels as they are reported in the Combo module. If the user selects a different PAS source for an instrument in the Combo module and in the individual instrument module, these channels may differ from their instrument-module equivalents. For example, the CIP LWC listed in the Combo module may be different than the CIP LWC listed in the CIP module.

Max Size (μm) specifies the maximum diameter that a particle detected by a given instrument can have and still be included in the Combo module’s calculations for Combined MVD and ED. For instruments that measure bigger particles, setting a maximum size allows you to omit large outliers such as raindrops, which can dramatically alter the results of these calculations.

In addition to affecting the Combined MVD and Combined ED calculations, Max Size affects individual instruments' ED, MVD, LWC, and Number Conc channels *that are listed in the Combo module*. Particles exceeding this maximum size are still included in all channels displayed on the relevant instrument's tab—e.g., CIP particles exceeding the max size would be factored into CIP MVD on the CIP tab. However, particles exceeding the max size are omitted from the Combo module's values for CIP MVD, CIP ED, CIP LWC, and CIP Number Conc. As a result, the CIP MVD displayed on the CIP tab, for instance, may differ from CIP MVD displayed on the Combo tab.

Local Manual PAS (m/s): The probe air speed value used for a given instrument if “Local Manual” is selected as the **PAS Source**.

After making changes in the 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.

2.2 Configuring the Combo Module Display

To configure the Combo module display, click on the Combo 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.

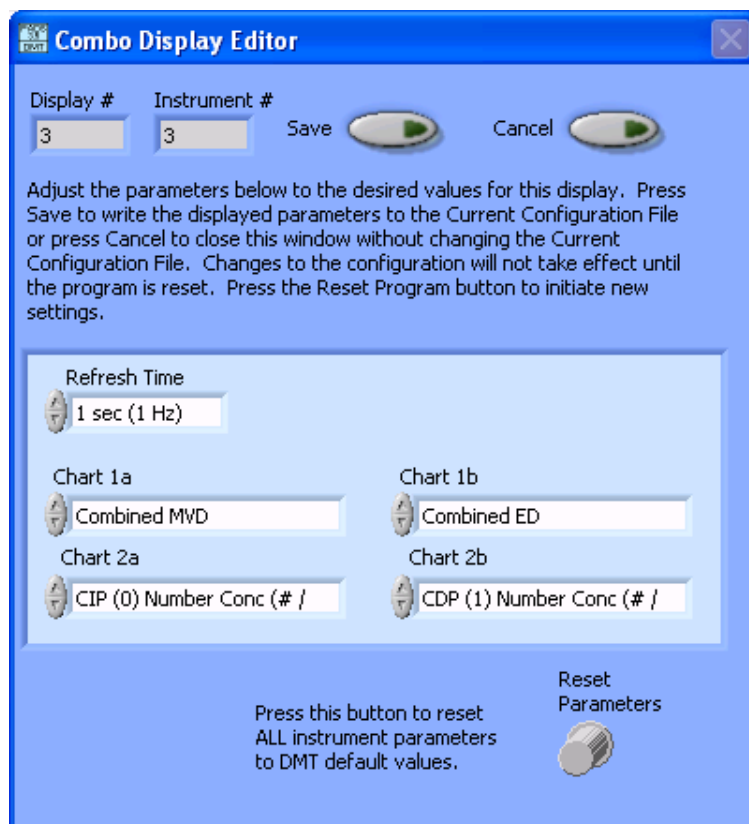


Figure 2: Combo Display Editor Window

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.)

Chart 1a, **Chart 1b**, **Chart 2a**, and **Chart 2b** allow you to configure the channels on the Combo module's selectable graphs. Chart 1 parameters apply to the graphs on the **Selectable Chart** sub-tab, while Chart 2 parameters apply to graphs on **Selectable Chart 2**. To change these channels, click on the arrow buttons to scroll between available options for the channels. You can also click on the white fields to bring up a list of all the available options, from which you can then choose the channel you want.

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.

3.0 The Combo Window

The Combo window consists of two selectable charts sub-tabs, a **Tools** sub-tab, and a combined histogram. These features are discussed below.

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

3.1 Selectable Charts Sub-tabs

Selectable Chart (Figure 3) and **Selectable Chart 2** each show a time-series chart of two user-selectable channels. The channel listed in the upper left is displayed in green, while the channel in the upper right is displayed in blue. Numeric values for these channels for the current moment in time appear in the boxes next to these controls (see the black arrows in Figure 3).

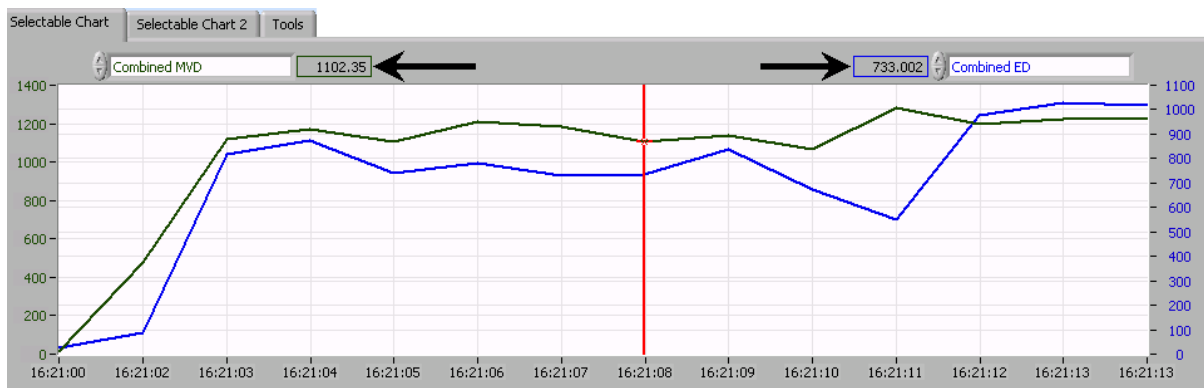



Figure 3: Combo Window's Selectable Chart Sub-Tab

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

- 1.) To change the charts for the current session only, click use the control in the upper left and right corners of the chart 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 channel. Then press the **Save** and **Reset Program** buttons to apply this configuration.

For information on specific channels, their definitions, and their acceptable ranges, consult *PADS Overview Manual's Appendix A: Definitions*.

3.1.1 Changing the Time Scale

There are two ways to change the time range displayed in the selectable charts. As described in the *PADS Overview Manual*, when reviewing data in playback mode, you can use the time-range controls (Figure 4) to zoom. To zoom in on the data, move the green and red controls close to the white control, which will narrow the range of displayed data. To zoom out, move the two colored controls away from the white control.

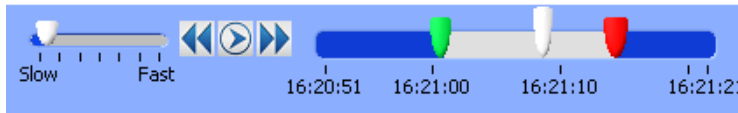


Figure 4: Time-Range Controls

On the plots themselves, you can also type numbers directly into the first and last labels on the x and y axis to change the scaling. Changing the x-axis labels this way will change the time range.

3.2 Tools Sub-Tab

The **Tools** sub-tab (Figure 5) lists configurable parameters for each instrument in the Combo module.

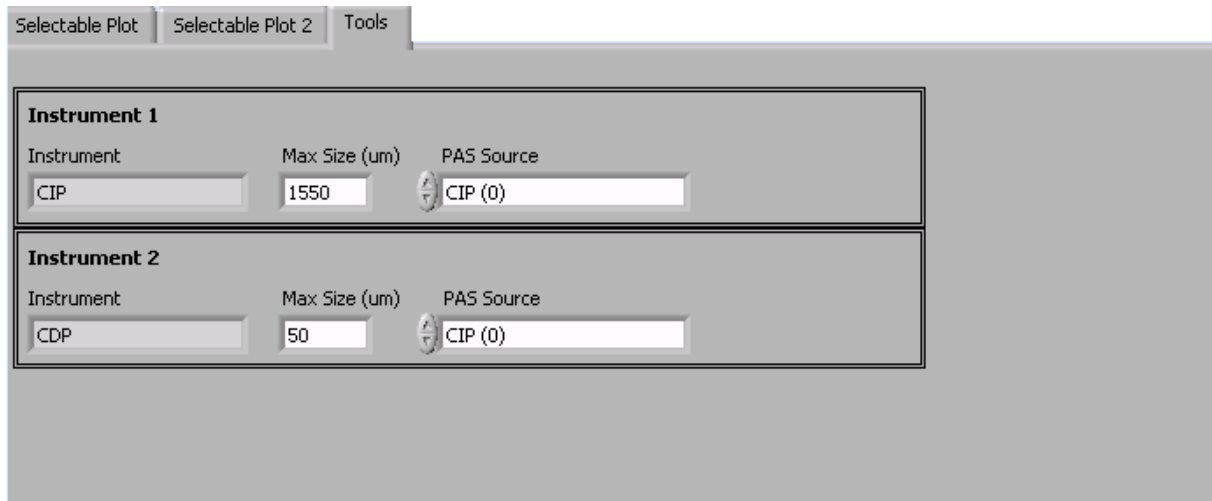


Figure 5: Combo Window's Tools Sub-Tab

Max Size (μm) specifies the maximum diameter that a particle detected by a given instrument can have and still be included in the Combo module. For instruments that measure bigger particles, setting a maximum size allows you to omit large outliers such as raindrops, which can dramatically alter the results of these calculations.

In addition to affecting the Combined MVD and Combined ED calculations, Max Size affects individual instruments' ED, MVD, LWC, and Number Conc channels *that are listed in the Combo module*. Particles exceeding this maximum size are still included in all channels displayed on the relevant instrument's tab—e.g., CIP particles exceeding the max size would be factored into CIP MVD on the CIP tab. However, particles exceeding the max size are omitted from the Combo module's values for CIP MVD, CIP ED, CIP LWC, and CIP Number Conc. As a result, the CIP MVD displayed on the CIP tab, for instance, may differ from CIP MVD displayed on the Combo tab.

PAS Source specifies from which of the following sources the system should obtain the applied probe air speed (PAS):

- 1.) A specific instrument in the system (this can be any instrument capable of measuring air speed)
- 2.) A "Global Manual" value entered on the **Setup** tab
- 3.) A "Local Manual" value. This value can be entered in the field that appears to the right of the **PAS Source** field when "Local Manual" is selected as the source.

Applied PAS is used to calculate sample volume. In flight conditions, you will typically want to select an instrument as the air speed source. However, you will need to enter manual air speed values during probe calibration.

PAS Source affects ED, MVD, LWC, and Number Conc channels as they are reported in the Combo module. If the user selects a different PAS source for an instrument in the Combo module and in the individual instrument module, these four channels may differ from their instrument-module equivalents. For example, the CIP MVD listed in the Combo module may be different than the CIP MVD listed in the CIP module.

Making changes to the parameters on the **Tools** tab affects the current PADS session only. To permanently change the values that are used for these parameters, edit configuration on the **Config Display Editor**, as described in section 2.2.

3.3 Combined Histogram

In the bottom half of the Combo window is a combined histogram (Figure 6). This chart displays combined particle counts from the system's component instruments. The

histogram for each instrument based on the current moment in time, and each instrument is shown in a different color.

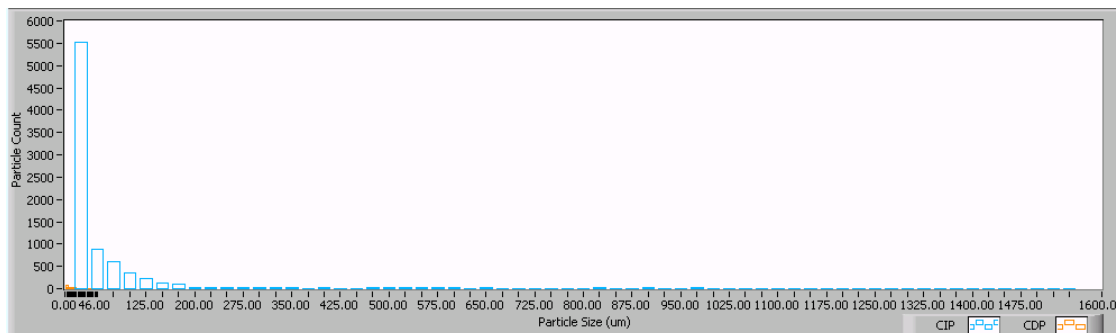


Figure 6: Combined Histogram

3.3.1 Zooming in and out on Chart Data

In some cases, you may want to zoom in on portions of the histogram. In Figure 6, for instance, the CIP particle sizes are so much larger than the CDP particle sizes that the latter are hardly visible. Zooming in on the bottom left portion of the chart displays the CDP particles in a much more readable format.

You have several options for zooming. First, you can change the scale by typing a different number into the starting and ending values on each axis. For instance, if you wanted to change Figure 6's maximum displayed particle size to 100, you would simply select the field that currently says 1600 and type in 100. You could also change the y-axis upper limit to 100 by typing 100 in the field that currently says 6000. This magnifies the CDP data as shown in Figure 7. *Note:* In acquisition mode, you should disable autoscaling (see below) before you modify fields in this way.

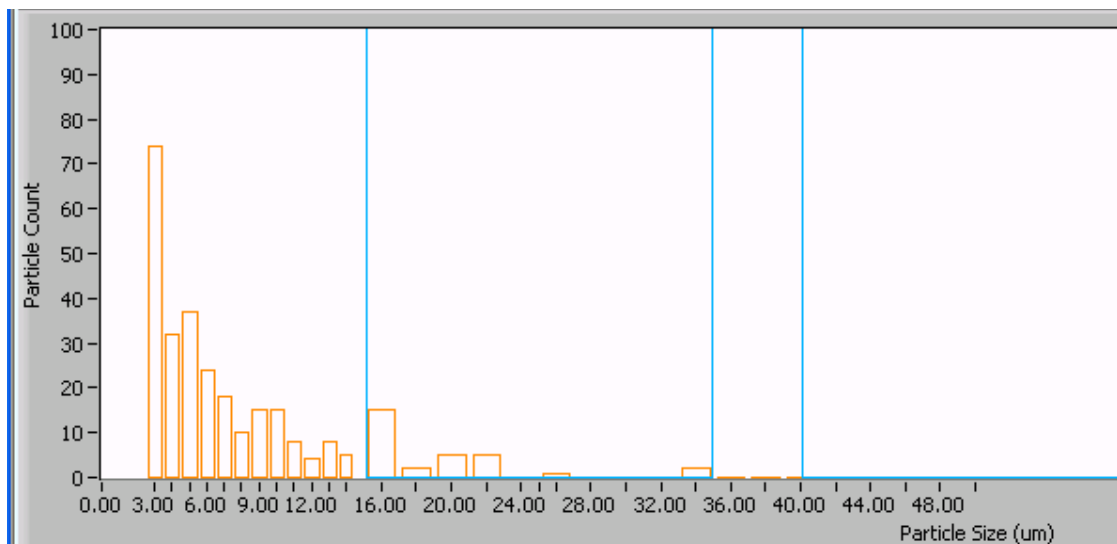


Figure 7: Enlarged CDP Data

3.3.2 Autoscaling and Copying Chart Data

The histogram also shows you options for autoscaling and copying the data when you right-click on the graph, which brings up a drop-down menu. These options are as follows:

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.

Appendix A: Combo Module Channels

Combo module output channels vary depending on the component instruments included in the system. The combo module will list channels for each component instrument in its output file. For the vast majority of these channels, the combo module simply records the value recorded by the individual instrument module—for instance, it takes the value of “CDP (1) bin 25” from the CDP module. An exception occurs if the max is low enough, in which case the combo module records a 0 for the bin count.

In some cases, however, the Combo module recalculates individual instrument channels depending on the Max Size (μm) parameter. This is the case for instruments’ MVD, ED, LWC and Number Conc channels. See section 3.2 for more details.

In addition, there are several channels specific to the Combo module:

- Combined MVD (μm)
- Combined ED (μm)
- [Instrument] Max Size (μm)
- [Instrument] Probe Air Speed (m/s)

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

Note that .raw output file channels differ slightly from .csv output channels. The .raw files contain bin counts from the instrument modules. The .csv files, as described above, contain these counts unless the bin is above Max Size (μm), in which case it contains zeros. The .raw files also do not contain the Combined MVD and Combined ED channels listed above. PADS uses this structure so that users can rescale .raw files with new Max Size (μm) or PAS Source parameters and obtain an updated. csv file.

Appendix B: Revisions to Manual

The Combo Module was introduced in PADS version 3.5. It replaces the CCP and CAPS modules in PADS 2.X. This manual replaces DOC-0191, the *PADS 2 CCP Summary Operator Manual*, and DOC-0197, the *PADS 2 CAPS Summary Operator Manual*.