Particle Analysis and Display System (PADS):
Cloud, Aerosol and Precipitation Spectrometer (CAPS) Summary Module

Operator Manual

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PADS 2.5.6, CAPS Module 2.5.3

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Consumable components, such as tubing, filters, pump diaphragms and Nafion humidifier are not covered by this warranty.

C O N T E N T S

L i s t   o f   F i g u r e s

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 Cloud, Aerosol and Precipitation Spectrometer (CAPS) summary display, which allows you to view and analyze data from the CAPS component sensors simultaneously.

For an explanation of the basic PADS setup and instructions on how to acquire data using PADS, consult the *PADS Operator Manual*. The *Operator Manual* also gives definitions for all the channels that the CAPS Summary displays.

2.0 Configuration

While the CAPS is an integrated system of sensors rather than an individual instrument, you can still configure its setup. The following section describes in detail how to do this. The next section explains how to configure the CAPS Summary display in PADS so that it shows you data in the desired formats.

Configuring the CAPS Summary

To configure the software for the CAPS summary, 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 "CAPS Summary" tab.

2. From the **Configure** menu, select **Configure Instrument.** You will see the following window.
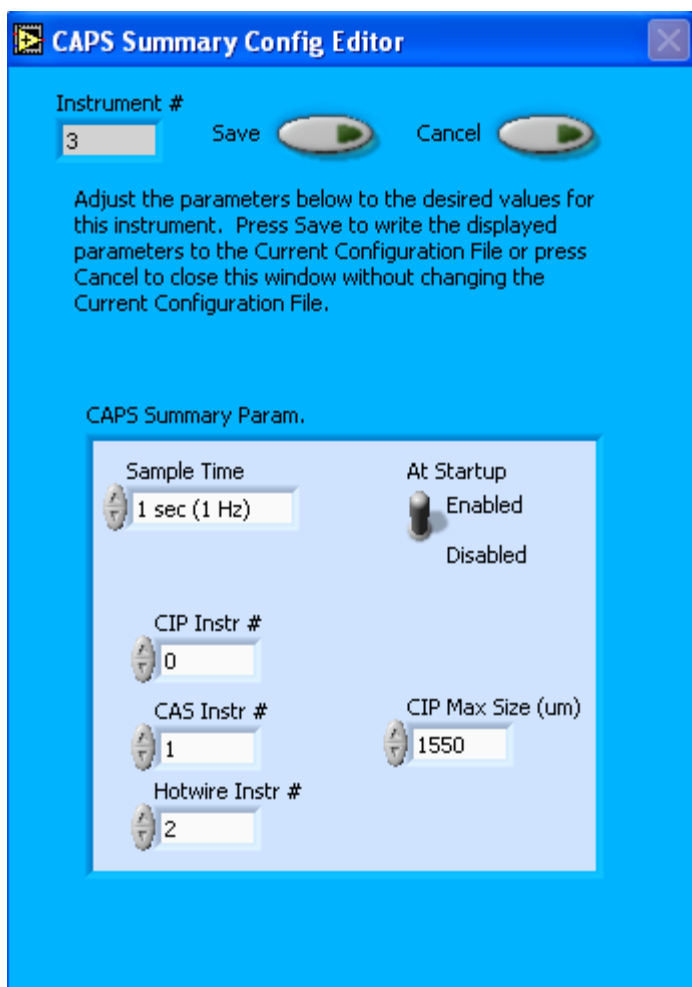
Figure 1: CAPS Configuration Editor Window

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 CAPS summary Parameters" and "Rarely Reconfigured CAPS summary Parameters." If at any time you would like to revert to the previously saved values for the CAPS summary parameters, press **Cancel** to exit the window without saving changes.

4. When you are done configuring the CAPS summary 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 CAPS summary Parameters

Sample Time: This parameter shows the time interval at which the CAPS summary collects data from its component sensors. You can have the probe sample at intervals of .1, .2, .5, 1, 2, 5, or 10 seconds (10, 5, 2, 1, 0.5 or 0.1 Hz). It is recommended that you set **Sample Time** to the fastest sample time among the component sensors, so that no data are lost. If the CAPS summary sample rate exceeds that of some component sensors, it will simply read the latest available data.

At Startup Enabled / Disabled: If you want the CAPS summary 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 CAPS component sensors are inoperative, you may want to use this control to disable the CAPS summary. Doing so allows data to transmit from other sensors without interference.

CIP Max Size (µm): The maximum diameter that a CIP-detected particle can have and still be included in the CAPS summary's calculations for CIP MVD, CIP ED, CIP LWC and CIP # Conc. Particles exceeding this maximum size are still included in calculations displayed on the CIP display screen and in the CIP output file, but they are omitted from CAPS summary calculations. As a result, the CIP MVD displayed on the CIP tab, for instance, may differ from CIP MVD displayed on the CAPS summary tab. Setting a maximum size for CIP MVD allows you to omit large outliers such as raindrops, which can dramatically alter the results of these calculations.

You will notice that there are other parameters listed on the **CAPS Summary 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 CAPS Summary Parameters" below or consult with a DMT technical representative.

Rarely Reconfigured CAPS Summary Parameters

The CAPS Summary 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 CAPS summary. If your CAPS summary 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.

CIP Instr #: The instrument number that has been assigned to the CIP. This number should match the **Instrument #** on the Config Editor screen for the CIP.

CAS Instr #: The instrument number that has been assigned to the CAS. This number should match the **Instrument #** on the Config Editor screen for the CAS.

Hotwire Instr #: The instrument number that has been assigned to the Hotwire LWC. This number should match the **Instrument #** on the Config Editor screen for the Hotwire_LWC.

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.

Configuring the CAPS Summary Display

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

To configure the CAPS Summary display, follow the steps below.

1. Click on the "CAPS Summary" tab.

2. From the **Configure** menu, select **Configure Display.** You will see the following window.
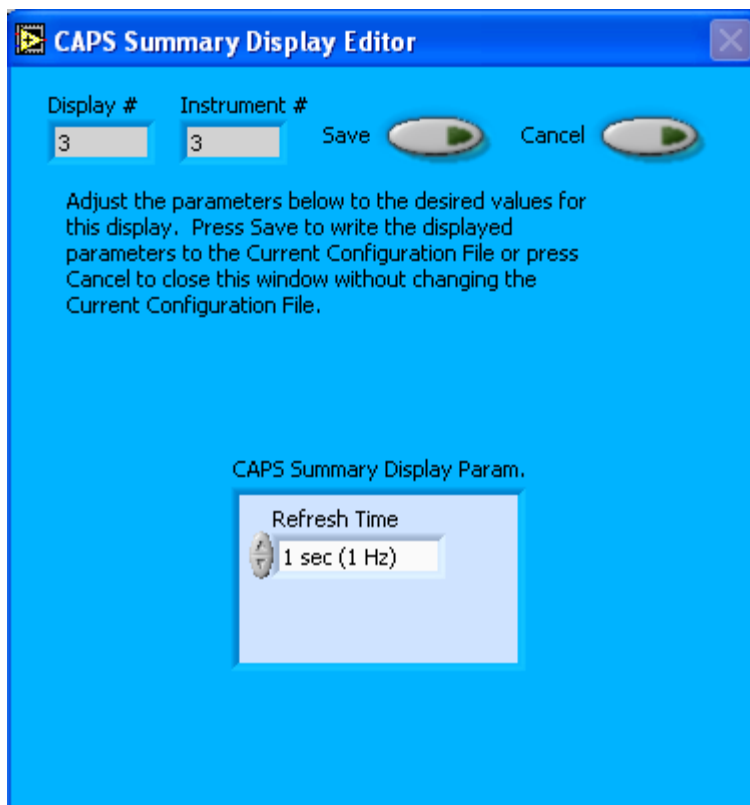
Figure 2: CAPS Summary Display Editor Window

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.

3.0 The CAPS Summary Window

The CAPS window consists of channel tabs, a total MVD chart, and CIP and CAS particle counter charts. These are discussed below. For explanations of the **Enable** button and **Fault/No Fault** button, see the "Instrument Tabs" section of the *PADS Operator Manual*. The **Max CIP size for MVD (µm)** control allows you to change the maximum diameter for CIP-detected particles included in several calculations. For details, see **CIP Max Size**

under the section "Occasionally Reconfigured CAPS Parameters." The default for this field is the value stipulated in the CAPS Summary Config Editor screen. You can change this value by pressing on the arrows or by typing a new value directly into the field.

Channel Tabs

In the top left of the CAPS screen are the channel tabs. The first tab, **CAPS Main Parameters**, displays key channels collected from the three CAPS Summary sensors—CIP, CAS and Hotwire LWC. This tab is shown in Figure 3. The second tab, **CAPS Diagnostics**, displays channels that indicate whether the sensors are functioning properly.
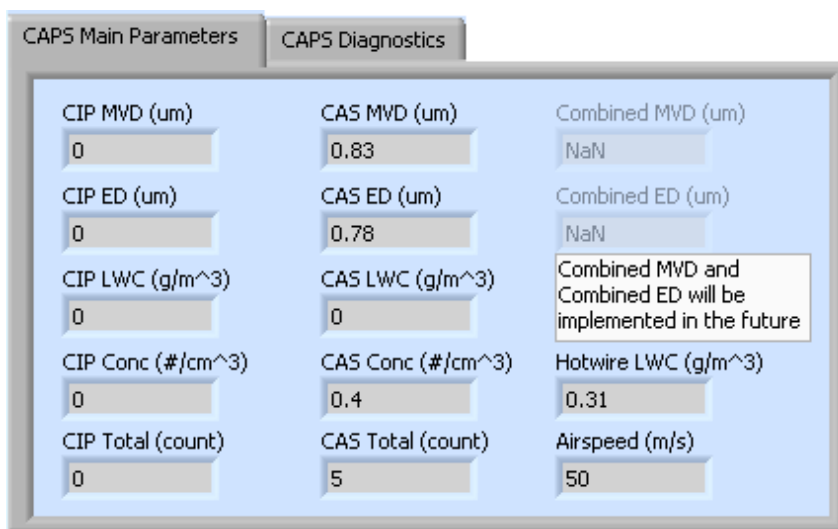
Figure 3: CAPS Main Parameters Tab

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

Total MVD Chart Display

To the right of the tabular channel data is a chart of the total MVD for the combined size distributions of the CIP and CAS. Currently the CAPS Summary does not calculate total MVD, so the graph does not display any data. In the future, however, the program will calculate and display this channel. *Note:* If you are reading a data file generated by an older version of the PADS CAPS Summary module, you may also see values for Total MVD.

CAS and CIP Particle Counters

In the bottom half of the CAPS Summary window are the CAS and CIP particle counters. These display a particle-size histogram for each instrument based on the current moment in time.

On both charts, 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 4's maximum displayed particle count to 10, you would simply select the field that currently says 100 and type in 10. In acquisition mode, you should disable autoscaling (see below) before you modify fields in this way.
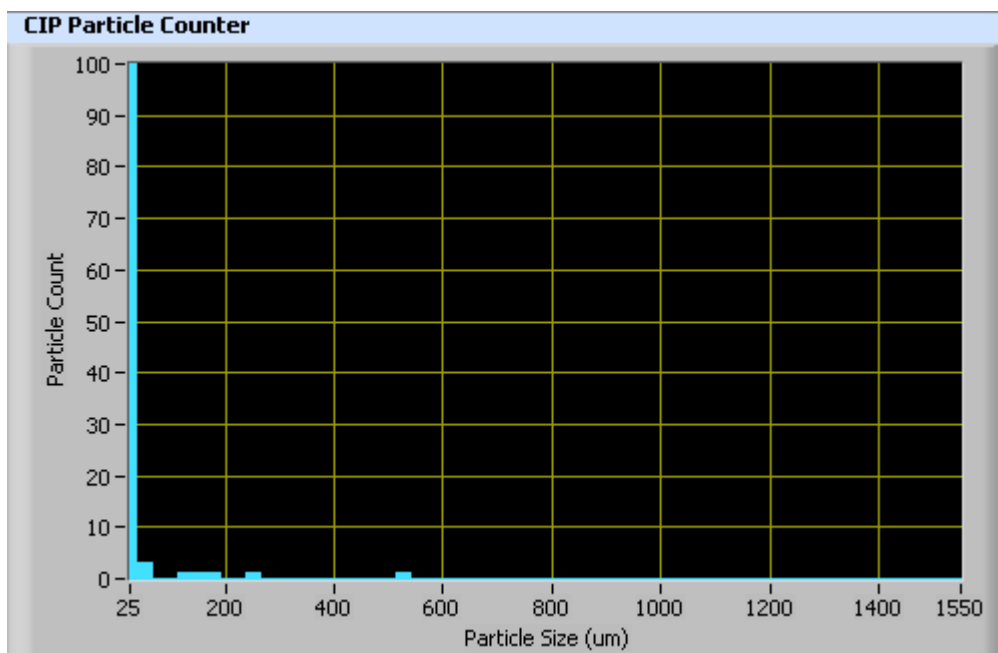
Figure 4: CIP Particle Counter

The charts also show you options for scaling and copying the data when you right-click on them. 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: CAPS Summary Channels

A complete list of CAPS Summary data channels appears below. The CAPS output file will contain data values for each channel for each sampling instance.

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

Time	CAS Bin 2	CIP Bin 3	CIP Bin 34
CAS MVD (um)	CAS Bin 3	CIP Bin 4	CIP Bin 35
CAS ED (um)	CAS Bin 4	CIP Bin 5	CIP Bin 36
CIP MVD(um)	CAS Bin 5	CIP Bin 6	CIP Bin 37
CIP ED (um)	CAS Bin 6	CIP Bin 7	CIP Bin 38
(reserved for Total MVD)	CAS Bin 7	CIP Bin 8	CIP Bin 39
(reserved for Total ED)	CAS Bin 8	CIP Bin 9	CIP Bin 40
LWC Hotwire (g/m^3)	CAS Bin 9	CIP Bin 10	CIP Bin 41
CAS LWC (g/m^3)	CAS Bin 10	CIP Bin 11	CIP Bin 42
CIP LWC (g/m^3)	CAS Bin 11	CIP Bin 12	CIP Bin 43
Airspeed	CAS Bin 12	CIP Bin 13	CIP Bin 44
CAS Total Count	CAS Bin 13	CIP Bin 14	CIP Bin 45
CAS Conc (#/cm^3)	CAS Bin 14	CIP Bin 15	CIP Bin 46
CAS Laser Curr (mA)	CAS Bin 15	CIP Bin 16	CIP Bin 47
CAS For TEC Temp (C)	CAS Bin 16	CIP Bin 17	CIP Bin 48
CAS Internal Temp (C)	CAS Bin 17	CIP Bin 18	CIP Bin 49
CIP Total Particles	CAS Bin 18	CIP Bin 19	CIP Bin 50
CIP Conc (#/cm^3)	CAS Bin 19	CIP Bin 20	CIP Bin 51
CIP Max Size for MVD	CAS Bin 20	CIP Bin 21	CIP Bin 52
CIP End Diode Rej	CAS Bin 21	CIP Bin 22	CIP Bin 53
CIP Over Range	CAS Bin 22	CIP Bin 23	CIP Bin 54
CIP Ambient Temp (C)	CAS Bin 23	CIP Bin 24	CIP Bin 55
CIP Diode Voltage 1	CAS Bin 24	CIP Bin 25	CIP Bin 56
CIP Diode Voltage 32	CAS Bin 25	CIP Bin 26	CIP Bin 57
CIP Diode Voltage 64	CAS Bin 26	CIP Bin 27	CIP Bin 58
CIP Laser Curr (mA)	CAS Bin 27	CIP Bin 28	CIP Bin 59
Hotwire LWC (V)	CAS Bin 28	CIP Bin 29	CIP Bin 60
LWC Slave (V)	CAS Bin 29	CIP Bin 30	CIP Bin 61
Static Pressure (mb)	CAS Bin 30	CIP Bin 31	CIP Bin 62
Pitot Pressure (mb)	CIP Bin 1	CIP Bin 32	Status
CAS Bin 1	CIP Bin 2	CIP Bin 33	GPS Time

CAPS Summary channels fall into several broad categories:

Time Channels: Time and GPS Time store time data. Time is generated by the PADS computer clock and is the time when the program receives the CIP data. GPS Time is included in every instrument's list of channels whenever a GPS is included as one of the PADS instruments.

Bin Channels: Channels labeled CAS Bin [*i*] and CIP Bin [*i*] store data on the number of particles of different sizes that the two probes have detected. These data are used in the particle-count histograms in the bottom half of the CAPS tab.

Channels for Other Statistical Data: CIP End Diode Reject, CIP Over Range, CIP Total Particles and CAS Total Count store particle statistics collected by the probes. Status stores statistical data the CAPS has gathered on the communication between itself and PADS.

Housekeeping Channels: Housekeeping channels are denoted by italics in the channels list above. CIP housekeeping channels are generated by a 12-bit A/D converter that converts a 0-10 V range to integer values from 0 to 4095. On the CAS, the input voltage range is 0-5 V.

Calculated Channels: Channels labeled ED, MVD, LWC, and Conc store the results of calculations PADS has performed on particle data. In future versions of PADS, the channels currently labeled "(reserved for Total MVD)" and "(reserved for total ED)" will be used to store MVD and ED calculations for combined CIP and CAS particle data.

Parameter Channel: CIP Max Size for MVD stores the setting for this instrument configuration parameter at the time of the sampling instance.

Global Channel: Airspeed holds the true air speed generated by the master source designated on the PADS Setup screen.