
**Particle Analysis and Display
System (PADS):
Cloud and Aerosol
Spectrometer Polarization
Option with Particle by
Particle (CAS_POL_PBP)
Module**

Operator Manual

DOC-0189 B

PADS 2.5.6, CAS_POL_PBP 2.5



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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.

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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 Cloud and Aerosol Spectrometer Polarization Option with Particle by Particle (CAS_POL_PBP).

Note: The CAS_POL_PBP tab in PADS displays data acquired by the CAS-DPOL instrument. The names refer to the same probe.

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 CAS_POL_PBP 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 CAS_POL_PBP

Your CAS_POL_PBP 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 “CAS_POL_PBP” tab.
2. From the **Configure** menu, select **Configure Instrument**. You will see the following window.

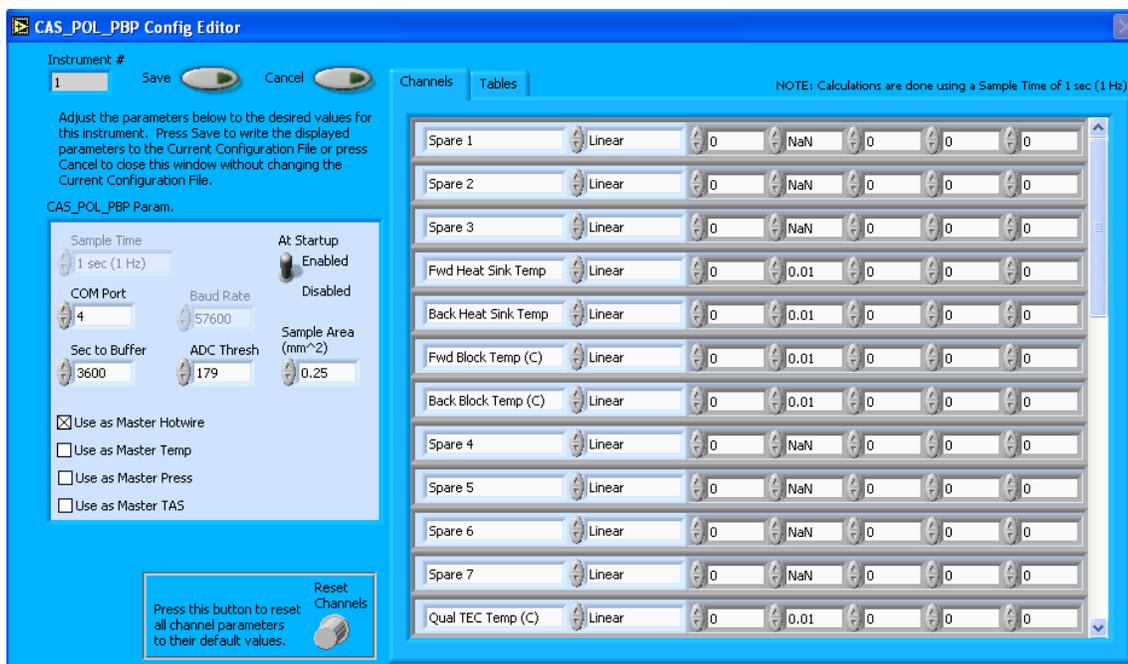


Figure 1: CAS_POL_PBP Configuration Editor Window. The left side of the window contains parameters for the instrument. The tabs on the right side of the window contain information on CAS_POL_PBP channels and threshold tables. (See “Rarely Reconfigured Parameters.”)

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 CAS_POL_PBP Parameters” and “Rarely Reconfigured CAS_POL_PBP Parameters.” If at any time you would like to revert to the previously saved values for the CAS_POL_PBP parameters, press **Cancel** to exit the window without saving changes.
4. When you are done configuring the CAS_POL_PBP 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 CAS_POL_PBP Parameters

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

COM Port: This is the serial communications port that the CAS_POL_PBP 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.

Sec to Buffer: The number of seconds that PADS stores data acquired by the CAS_POL_PBP in its memory. One hour has been chosen as the default setting because this is the maximum length of time that data can be stored without taxing computer memory.

ADC Threshold: The ADC Threshold indicates the smallest peak digital value a particle can have and still be sized by the instrument. Small digital peaks can occasionally occur in the absence of particles, and the ADC Threshold can be used to eliminate such noise.

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

Rarely Reconfigured CAS_POL_PBP Parameters

The CAS_POL_PBP 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.

Sample Time: This parameter shows the time interval between samples. It is currently set to one Hertz / one second, as choosing other values will invalidate time-dependent PADS calculations. The field has been grayed out so you cannot change it.

Instrument #: This lists the number corresponding to the instrument you are viewing, in this case the CAS_POL_PBP. If your CAS_POL_PBP 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.

Baud Rate: The Baud rate for the probe is defined at manufacture, and you should not need to change it. PADS lists this parameter because some probes can run at different baud rates. So if you reconfigure your hardware, 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.

Sample Area: This is the physical area in which particles are detected. CAS_POL_PBP sample area is a constant regardless of particle size. This value is preconfigured to match your instrument, so it is strongly suggested that you do not change it.

Use as Master Hotwire: When checked, this box tells PADS to use the CAS_POL_PBP's hotwire measurement as the default master hotwire source on the Setup window. While multiple instruments can potentially provide this measurement, only one instrument should be selected as the source.

Note that in a CCP system, the Hotwire signal is measured by the CIP. In a CAPS system, the Hotwire signal is usually measured by the CAS_POL_PBP, so the CAS_POL_PBP and not the CIP should be set to Use as Master Hotwire for these systems.

Use as Master Temp: When checked, this box tells PADS to use the CAS_POL_PBP's ambient temperature measurement as the default master temperature source on the Setup window. While multiple instruments can potentially provide this measurement, only one instrument should be selected as the source. (Note that what PADS displays as ambient temperature is really measured temperature that is several degrees warmer than the ambient; see entry under **Ambient Temperature** in the *PADS Operator Manual's Appendix A.*)

Use as Master Press: When checked, this box tells PADS to use the CAS_POL_PBP's static pressure measurement as the default master source for static pressure. This source appears on the PADS Setup window upon startup. While multiple instruments can potentially provide this measurement, only one instrument should be selected as the source.

Use as Master TAS: When checked, this box tells PADS to use the CAS_POL_PBP’s True Air Speed measurement as the TAS Source on the Setup window.

Several different instruments are capable of providing True Air Speed to PADS. If more than one such instrument is installed in your system, only one of them can be used as the global source for True Air Speed for calculations. When your system comes from DMT, one instrument will be selected as the Master TAS.

Channels: The 31 channels listed in the channels table are configurable. These are housekeeping channels associated with the instruments internal sensors, for example a pressure or temperature sensor. They are sampled with an A/D channel that converts a voltage between 0 and 10 Volts to a integer value from 0 to 4095.

The integer values returned by these channels can be turned into other, more meaningful units (e.g., mBar or °C) by using a conversion equation. You can specify this equation in the channels table.

The second column in the table indicates the type of equation that PADS should use—linear, polynomial, or none. (Do not use the “CAS Temp.” option, which is reserved for internal use.) “Linear” indicates a linear equation, while “4th Order Poly” indicates a higher order polynomial equation with up to five terms. “None” means the digital value (between 0 and 4095) will be returned without any scaling.

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 digitized analog value returned by the A/D converter.



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.

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.

If your CAS_POL_PBP is a stand-alone instrument, some of the spare channels listed in Figure 1 may be replaced by channels such as Dynamic Pressure, Static Pressure, and Ambient Temperature. If your system has other instruments, these other instruments will likely report these channels and they will remain as spares on the CAS_POL_PBP.

Clicking the “Reset Channels” knob at the bottom of the Config Editor window will reset all the channel parameters to their DMT-supplied default values.

Tables: The second tab on the right-hand side of the Config Editor screen displays the threshold table and the bin-size table. The CAS_POL_PBP uses both these tables to classify and size particles it detects. The threshold table tells PADS the correct sizing bin for a particle given the peak digital value from the light scattered by the particle. The sizing bin tells PADS the upper size boundary in microns for each bin. You can use the arrows and field to the left of each table to click to different rows or to specify the top row number in the data displayed.

The final value in the threshold table should always be set to 9216. The CAS_POL_PBP classifies particles with higher peak signals as oversized and does not display them in the histogram, so setting the final threshold table cell above 9216 is not useful. On the other hand, setting the value lower than 9216 may result in the histogram displaying data inaccurately, as particle events above the last bin’s upper boundary are categorized in bin 0.

Clicking the “Reset Tables” knob at the bottom right of the Config Editor window will reset all the tabular data to their DMT-supplied 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. Clicking **Reset Program** will clear any data PADS is currently displaying.

Configuring the CAS_POL_PBP Display

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

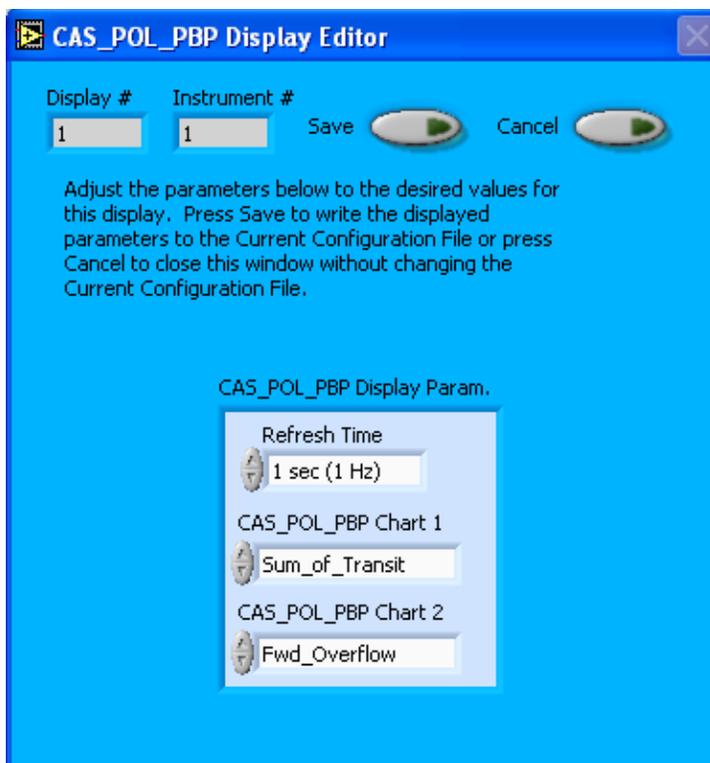


Figure 3: CAS_POL_PBP Display Editor Window

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 CAS_POL_PBP Display Parameter box at the bottom of the window also allows you to configure the channels on the CAS_POL_PBP's selectable graphs. 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. Note that clicking **Reset Program** will clear out any data currently being displayed.

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

3.0 The CAS_POL_PBP Window

The different parts of the CAS_POL_PBP 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*.

Channel Tabs

The CAS_POL_PBP Calc Data and Housekeeping tabs are displayed in upper left of the CAS tab, as shown in Figure 4. The information PADS displays in these tabs is specific to the time listed in the upper-right of the PADS window.

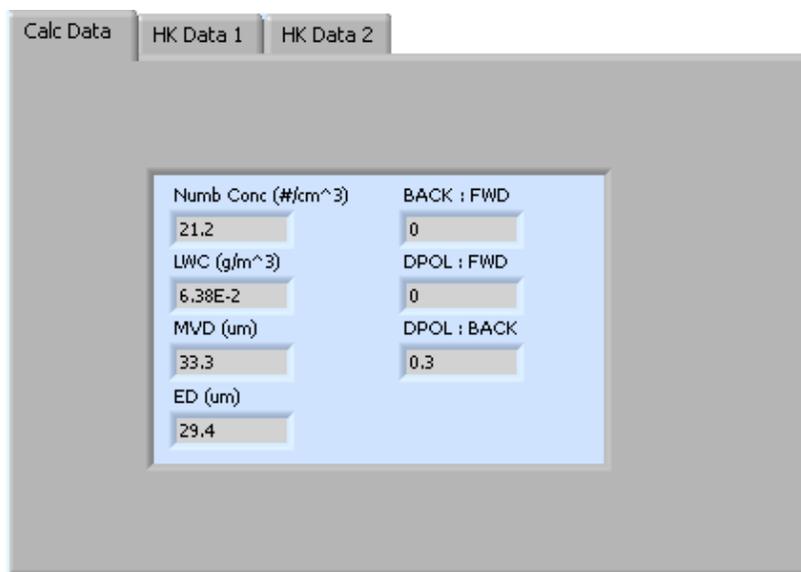


Figure 4: CAS_POL_PBP Calc Data Window

Note that housekeeping fields may vary depending on the housekeeping channels you have selected for the instrument on the Config Editor screen.

More information on these calculated parameters can be found in *Appendix A: CAS_POL_PBP Channels*.

Histogram Data Window

Below the CAS_POL_PBP Data and Housekeeping tabs is the histogram display of acquired particle data, as shown in Figure 5. PADS generates this histogram using data collected from the instrument’s forward-scattering optics. The histogram shows the distribution of particles by size. The x-axis labels indicate the upper boundary of each size bin, which PADS reads from the Bin Sizes table on the **Config Editor** window. A bin’s lower boundary

is the upper boundary of the previous bin, except for the first bin, which has a lower boundary of .5 μm .

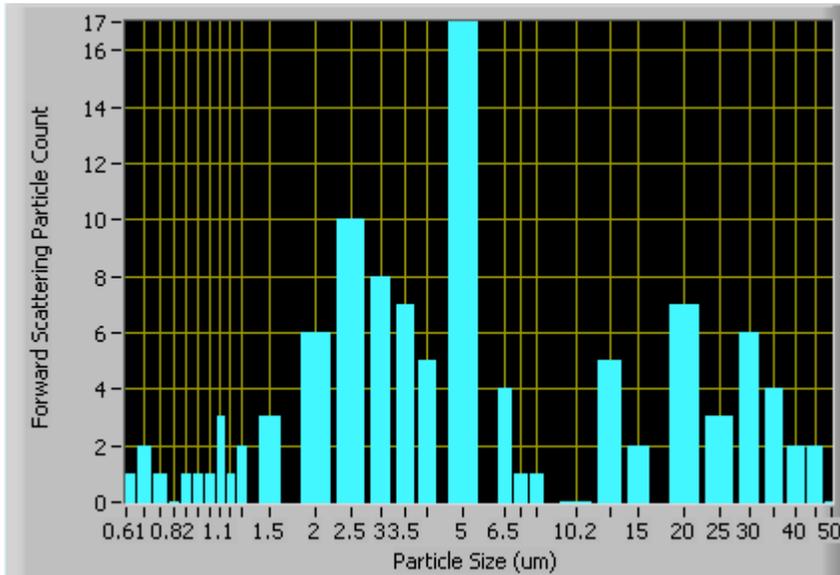


Figure 5: CAS_POL_PBP Histogram Display

Chart Displays

The CAS_POL_PBP chart displays consist of tabs with standard charts, selectable charts, and particle by particle (PBP) data. You can access any of these charts by selecting the tabs in the upper part of the chart display window. Figure 6 shows these tabs and the standard time-series charts.

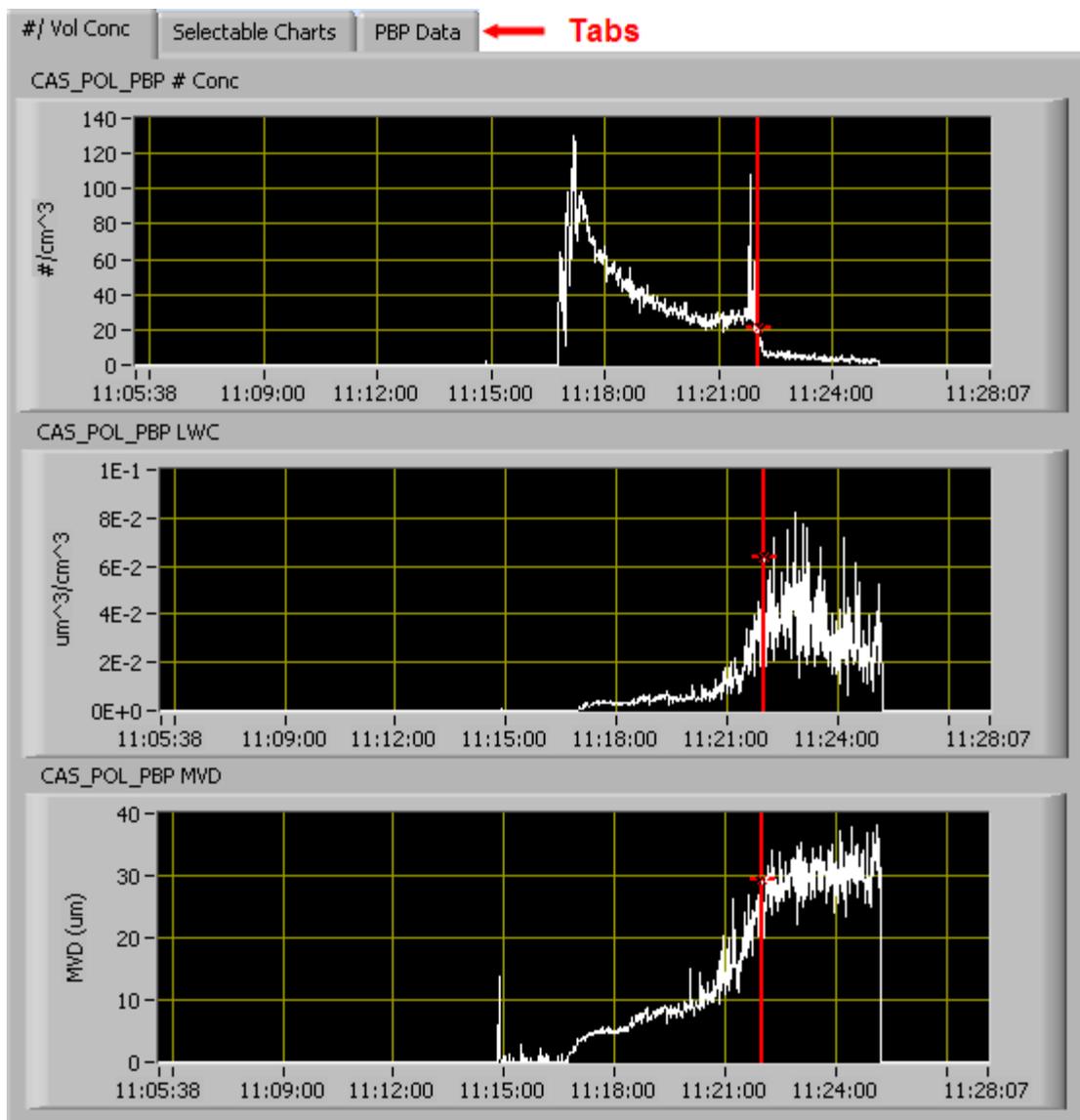


Figure 6: CAS_POL_PBP Time-Series Charts

When you access time-series charts in playback mode, the currently selected moment in time is indicated by a red cursor, as shown above. The y-axis value for this time is indicated by cross (+) on this cursor. 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.

On all the charts with x and y axes, you can change the scale by typing a different number into the starting and ending values on each axis. For instance, if you want to change the time period in one of the graphs above to end at 11:15:00, you simply select the field that currently says 11:28:07, type in 11:15:00, and hit the <Enter> key. In acquisition mode, you must disable autoscaling (see below) before you modify fields in this way.

Many 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.

More information about each of the tabs on the chart displays section is given below.

1. Standard Charts (the #/Vol Conc Tab)

The three graphs on the first tab display particle number concentration ($\#/cm^3$), LWC (g/m^3) and MVD (μm). PADS incorrectly labels LWC units as $\mu m^3/cm^3$. This is a known bug that will be fixed in an upcoming version of the program.

In playback mode, you can zoom in or out on the charts by using the time controls. In acquisition mode, use the “Display Range” control to zoom in or out.

2. Selectable Charts

The **CAS_POL_PBP Selectable Charts** tab displays two charts with user-specified channels plotted as a function of time. To change the channels plotted in the selectable charts, you have two options:

- 1.) To change the charts for the current session only, click on the **CAS_POL_PBP Selectable Charts** tab and use the control in the upper left 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 **Reset Changes** button to apply this configuration.

3. *PBP Data*

The PBP Data tab displays particle-by-particle data for the sample time listed in the upper right of the CAS_POL_PBP window. The histogram displays particle counts as a function of inter-particle time (IPT) in milliseconds. The fields above the histogram display the average IPT time and the standard deviation from the mean. To the right of these fields are radio buttons that allow you to display the data linearly or logarithmically.

Note that on this histogram, LabVIEW erroneously displays y-axis labels with only one digit of resolution, as shown in Figure 7. You can infer more precise labels using the labels closest to the origin. In Figure 7, for instance, the first few labels indicate a scale of two counts per tick mark, so the three tick marks labeled 10 should really be 10, 12 and 14. This is a known bug that will be fixed in an upcoming version of PADS.

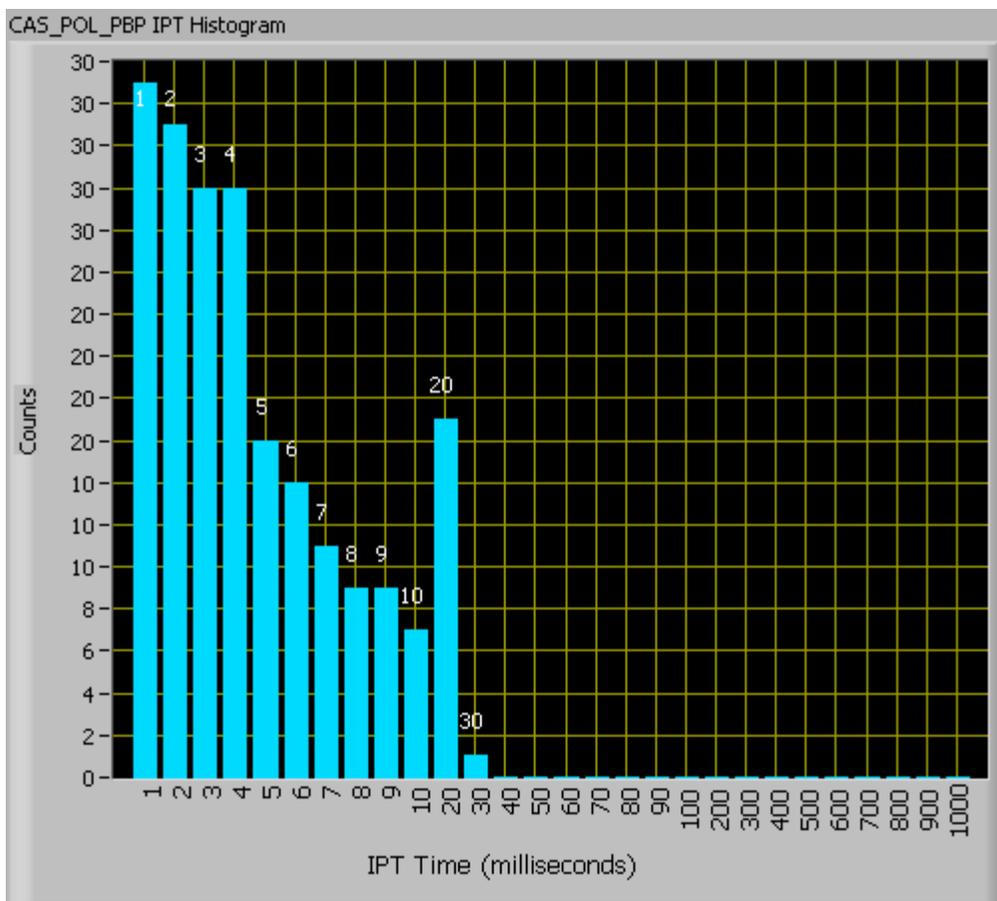


Figure 7: Imprecise Y-Axis Labels on the IPT Histogram

The IPT histogram displays data collected in the 28 CAS_POL_PBP_IPT_Bin channels. IPT Time ranges for each bin are given in Table 1. Note that the Bin 28’s upper boundary is really 1677.72, not the 1000 that PADS displays. This is the longest inter-particle time that the CDP_PBP can detect.

Bin	IPT (msec)						
1	0 - 1	8	7 - 8	15	50 - 60	22	300 - 400
2	1 - 2	9	8 - 9	16	60 - 70	23	400 - 500
3	2 - 3	10	9 - 10	17	70 - 80	24	500 - 600
4	3 - 4	11	10 - 20	18	80 - 90	25	600 - 700
5	4 - 5	12	20 - 30	19	90 - 100	26	700 - 800
6	5 - 6	13	30 - 40	20	100 - 200	27	800 - 900
7	6 - 7	14	40 - 50	21	200 - 300	28	900 - 1678

Table 1: IPT Time Ranges for CDP_PBP_IPT Bins

Appendix A: CAS_POL_PBP Channels

The CAS_POL_PBP generates two output files. These will be named something like the following:

- 01CAS_POL_PBP20081022110533.csv
- 01CAS_POL_PBP20081022110533_PBP.csv

The first file contains CAS_POL_PBP output gathered over each sampling instance. This file contains data on all the particles the probe has detected. The second file, which has “PBP” appended to its name, contains particle-by-particle data. PADS collects particle-by-particle data only for the first 292 particles detected in each sampling instance. If more than 292 particles arrive in the sampling interval, they are ignored in the second file but included in calculations of concentration, LWC, and MVD that are recorded in the first file. If no qualified particles are detected during a given sampling instance, the PBP file will not store any data. More information about these two files is given below.

For definitions of the channels, consult *Appendix A: Definitions* in the *PADS Operator Manual*.

1.) Main CAS_POL_PBP file

The main file will typically have the channels listed below. The channels in italics are configurable housekeeping channels, so they may be different on your instrument. Spare channels 1 - 7 are generally not used on CAS_POL_PBPs that are part of multi-instrument systems. On stand-alone CAS_POL_PBPs, these channels are renamed and store data relating to pressure, temperature, and the photodiodes (see the list below). You can plot any CAS_POL_PBP channel with respect to time using the Selectable Charts tab.

Time	<i>Back Heat Sink Temp (C)</i>	<i>Qual Low Gain Baseline (V)</i>
Sum_of_Transit	<i>Fwd Block Temp (C)</i>	<i>Fwd High Gain Baseline (V)</i>
Sum_of_DOF	<i>Back Block Temp (C)</i>	<i>Fwd Mid Gain Baseline (V)</i>
Fwd_Overflow	<i>Spare 4 / Photodiode 1</i>	<i>Fwd Low Gain Baseline (V)</i>
Back_Overflow	<i>Spare 5 / Photodiode 2</i>	<i>Back High Gain Baseline (V)</i>
Dpol_Overflow	<i>Spare 6 / Photodiode 3</i>	<i>Back Mid Gain Baseline (V)</i>
Reserved_0	<i>Spare 7 / Photodiode 4</i>	<i>Dpol Baseline (V)</i>
Reserved_1	<i>Qual TEC Temp (C)</i>	<i>Internal Temp (C)</i>
Reserved_2	<i>Fwd TEC Temp (C)</i>	<i>Dpol TEC Temp (C)</i>
<i>Spare 1 / Pitot Pressure</i>	<i>Back TEC Temp (C)</i>	<i>Dpol Heat Sink Temp (C)</i>
<i>Spare 2 / Static Pressure</i>	<i>Qual Heat Sink Temp (C)</i>	<i>Hotwire LWC (V)</i>
<i>Spare 3 / Ambient Temperature</i>	<i>Qual High Gain Baseline (V)</i>	<i>LWC Slave (V)</i>
<i>Fwd Heat Sink Temp (C)</i>	<i>Qual Mid Gain Baseline (V)</i>	<i>Laser Current Monitor (V)</i>

<i>Laser Power Monitor (V)</i>	CAS_POL_PBP_Bin_25	CAS_POL_PBP_IPT_Bin_5
CAS_POL_PBP_Bin_1	CAS_POL_PBP_Bin_26	CAS_POL_PBP_IPT_Bin_6
CAS_POL_PBP_Bin_2	CAS_POL_PBP_Bin_27	CAS_POL_PBP_IPT_Bin_7
CAS_POL_PBP_Bin_3	CAS_POL_PBP_Bin_28	CAS_POL_PBP_IPT_Bin_8
CAS_POL_PBP_Bin_4	CAS_POL_PBP_Bin_29	CAS_POL_PBP_IPT_Bin_9
CAS_POL_PBP_Bin_5	CAS_POL_PBP_Bin_30	CAS_POL_PBP_IPT_Bin_10
CAS_POL_PBP_Bin_6	CAS TAS	CAS_POL_PBP_IPT_Bin_11
CAS_POL_PBP_Bin_7	Global TAS	CAS_POL_PBP_IPT_Bin_12
CAS_POL_PBP_Bin_8	Global Static Pressure	CAS_POL_PBP_IPT_Bin_13
CAS_POL_PBP_Bin_9	Global Ambient Temp	CAS_POL_PBP_IPT_Bin_14
CAS_POL_PBP_Bin_10	Global Hotwire	CAS_POL_PBP_IPT_Bin_15
CAS_POL_PBP_Bin_11	Global Hotwire Slave	CAS_POL_PBP_IPT_Bin_16
CAS_POL_PBP_Bin_12	#_Conc	CAS_POL_PBP_IPT_Bin_17
CAS_POL_PBP_Bin_13	LWC	CAS_POL_PBP_IPT_Bin_18
CAS_POL_PBP_Bin_14	MVD	CAS_POL_PBP_IPT_Bin_19
CAS_POL_PBP_Bin_15	ED	CAS_POL_PBP_IPT_Bin_20
CAS_POL_PBP_Bin_16	Back : Fwd	CAS_POL_PBP_IPT_Bin_21
CAS_POL_PBP_Bin_17	Dpol : Fwd	CAS_POL_PBP_IPT_Bin_22
CAS_POL_PBP_Bin_18	Dpol : Back	CAS_POL_PBP_IPT_Bin_23
CAS_POL_PBP_Bin_19	PBP Avg IPT (msec)	CAS_POL_PBP_IPT_Bin_24
CAS_POL_PBP_Bin_20	PBP IPT Std Dev (msec)	CAS_POL_PBP_IPT_Bin_25
CAS_POL_PBP_Bin_21	CAS_POL_PBP_IPT_Bin_1	CAS_POL_PBP_IPT_Bin_26
CAS_POL_PBP_Bin_22	CAS_POL_PBP_IPT_Bin_2	CAS_POL_PBP_IPT_Bin_27
CAS_POL_PBP_Bin_23	CAS_POL_PBP_IPT_Bin_3	CAS_POL_PBP_IPT_Bin_28
CAS_POL_PBP_Bin_24	CAS_POL_PBP_IPT_Bin_4	Status
		GPS Time

2.) The CAS_POL_PBP Particle by Particle File

The output second file has PBP appended to its name and contains particle-by-particle data. The file lists five channels in five columns:

- Time
- Forward Size (counts)
- Back Size (counts)
- DePol Size (counts)
- IPT (msec)

These five channels get reported for the first 292 particles that the CAS_POL_PBP detects in each sampling instance.

CAS_POL_PBP 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 CAS_POL_PBP data. It is given in seconds after midnight on the day the program was started. GPS Time is included in every instrument's list of channels whenever a GPS is included as one of the PADS instruments. GPS Time may be collected from an instrument other than the CAS_POL_PBP, even though it appears as a channel in the CAS_POL_PBP output file.

Bin Channels: Channels labeled CAS_POL_PBP_Bin_[i] and CAS_POL_PBP_IPT_Bin_[i] categorize particles by size and inter-particle times. These data are used in the histogram displays. Note that CAS_POL_PBP_IPT_Bin channels only store data on particles observed during the particle-by-particle analysis.

Channels for Other Statistical Data: Sum_of_Transit, Sum_of_DOF, Fwd_Overflow, Back_Overflow, and Dpol_Overflow store particle statistics collected by the CAS_POL_PBP. Status stores statistical data the CAS_POL_PBP has gathered on the communication between PADS and the probe.

Housekeeping Channels: The CAS_POL_PBP has 31 A/D housekeeping channels that have a 0-10 V range measured by a 12-bit A/D converter that gives integer values from 0 to 4095. Several of the housekeeping channels store data that indicate whether the probe is functioning properly. The housekeeping channels are denoted by italics in the channels list.

Global Channels: Global TAS, Global Static Pressure, Global Ambient Temp, Global Hotwire, and Global Hotwire Slave store global data collected by the master source instruments designated on the Setup screen.

CAS_POL_PBP Calculated Channels: CAS TAS, #_Conc, LWC, MVD, ED, Back : Fwd, Dpol : Fwd, Dpol : Back, PBP Avg IPT, and PBP IPT Std Dev store the results of calculations PADS has performed on CAS_POL_PBP particle data.

Channels that are Currently Nonfunctional or Reserved for Internal Use: These channels include Reserved_[i], Spare_[i], and Photodiode_[i]. (Spare_[i] and the Photodiode_[i] are only channels on some CAS_POL_PBPs.)

Particle-By-Particle Channels: These include Forward Size (counts), Back Size (counts), DePol Size (counts), and IPT (msec). These four channels, along with Time, are stored in the output file with PBP appended to its name. The size is given in A/D counts and needs to be converted to a size in μm in post-processing using the appropriate conversion factors.

Appendix B: Adjusting PBP Size Count Channels so They Scale Linearly

The pbp CAS_POL_PBP output file has three channels that store data on particles' peak signals: Forward Size, Backward Size, and DePol Size. The first two channels do not scale linearly, because the forward-scattering detector and backward-scattering detector use different gain stages for particles that emit weaker or stronger signals. DePol Size scales linearly, since the depolarized detector has only one gain stage. (Note that linearity in this discussion refers only to optical-scattering cross-section measurements, not to particle size.)

In order to calculate the ratios Back : Fwd, Dpol : Fwd, and Dpol : Back—three channels that appear in the main CAS_POL_PBP output file—PADS must first scale Forward Size and Backward Size counts linearly. It uses the algorithms given below to do so. These algorithms are also useful should you want to convert Forward and Backward PBP data to a linear scale for your own analysis.

Note that there is a small overlap between gain stages, which depends on the calibration of your particular instrument. These calibrations are documented for your instrument, though accurate interpretation of them may require additional consultation with DMT. As a result of the overlapping gain stages, even the adjusted scales will not be perfectly linear; where overlap occurs, digital counts may jump slightly. Nonetheless, the adjusted sizes yielded by the algorithms correspond much more closely to scattered light than do the raw forward and backward size channels.

To Scale Forward Sizes:

Assume [Forward Size] is your raw reading and you wish to obtain an adjusted, linearly scaled reading, [Adjusted Forward]:

If $20 \leq [\text{Forward Size}] \leq 3071$,

$$[\text{Adjusted Forward}] = [\text{Forward Size}]$$

If $3072 \leq [\text{Forward Size}] \leq 6143$

$$[\text{Adjusted Forward}] = ([\text{Forward Size}] - 3071) \cdot 22$$

If $6143 < [\text{Forward Size}] < 9216$

$$[\text{Adjusted Forward}] = ([\text{Forward Size}] - 6143) \cdot 506$$

The values 22 and 506 represent the multiplication factors between the mid and low gain stages, respectively, and the high gain stage. If [Forward Size] exceeds 9216, the particle is oversized and PADS will not size it in the histogram. Instead, it will be counted in the Fwd_Overflow channel in the main CAS_POL_PBP output file. If the particle has been observed during particle-by-particle analysis, the Forward Size channel in the PBP file will be set to 12287.

To Scale Backward Sizes:

Assume [Backward Size] is your raw reading and you wish to obtain an adjusted, linearly scaled reading, [Adjusted Backward]:

If $0 \leq [\text{Backward Size}] \leq 1536$,

$$[\text{Adjusted Backward}] = [\text{Backward Size}]$$

If $1537 \leq [\text{Backward Size}] \leq 3071$

$$[\text{Adjusted Backward}] = ([\text{Backward Size}] - 1536) \cdot 22$$

If [Backward Size] exceeds 3071, PADS counts it in the Fwd_Overflow channel in the main CAS_POL_PBP output file. If the particle has been observed during particle-by-particle analysis, the Back Size channel in the PBP file will be set to 4095.

Note: the calibration coefficients 22 and 506 are the ones PADS uses to compute the three ratio channels mentioned above. As discussed, however, the coefficients for your particular instrument may be slightly different. For more information, consult DMT.

Appendix C: Revisions to Manual

Rev. Date	Rev No.	Summary	Section
9-24-10	B	Corrected formulas for linear scaling	Appendix B