Particle Analysis and Display System (PADS):

Cloud Condensation Nuclei Counter (CCN) Module

Operator Manual

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PADS 2.5.6, CCN Module 2.5.1

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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 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 Condensation Nuclei Counter (CCN).

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 CCN 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 CCN

Your CCN 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 "CCN" tab.

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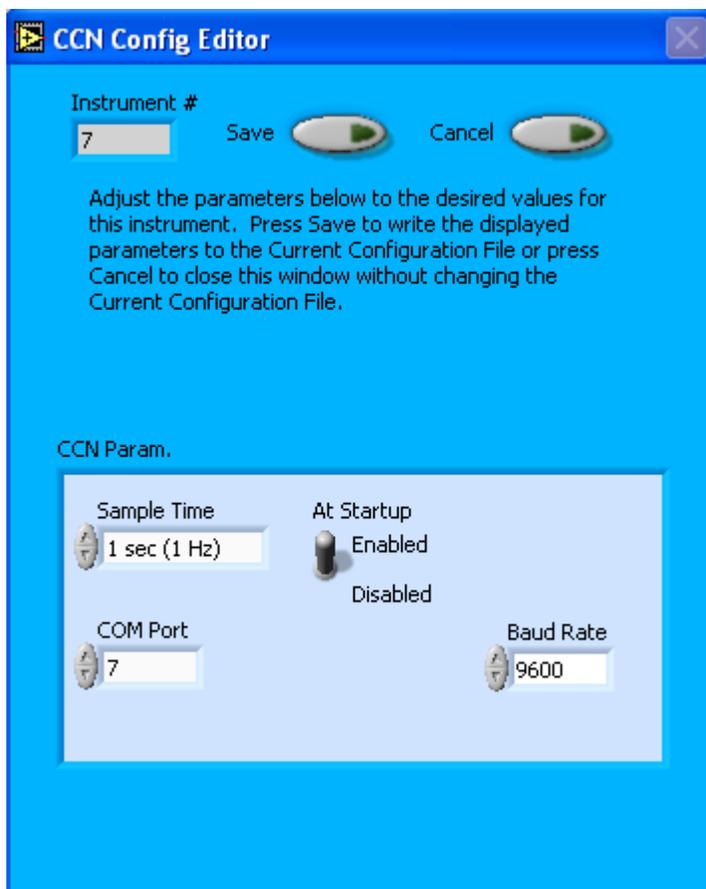
Figure 1: CCN Configuration Editor Window

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

4. When you are done configuring the CCN 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 CCN Parameters

Sample Time: Since the CCN relays particle data at one-second intervals, this parameter should always be set to 1 sec / 1 Hz.

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

COM Port: This is the serial communications port that the CCN 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 **CCN Config Editor** window. You should not need to change these, and changing them 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 CCN Parameters" below or consult with a DMT technical representative.

Rarely Reconfigured CCN Parameters

The CCN 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 CCN. If your CCN 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.

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 CCN Display

To configure the CCN display, click on the CCN 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.
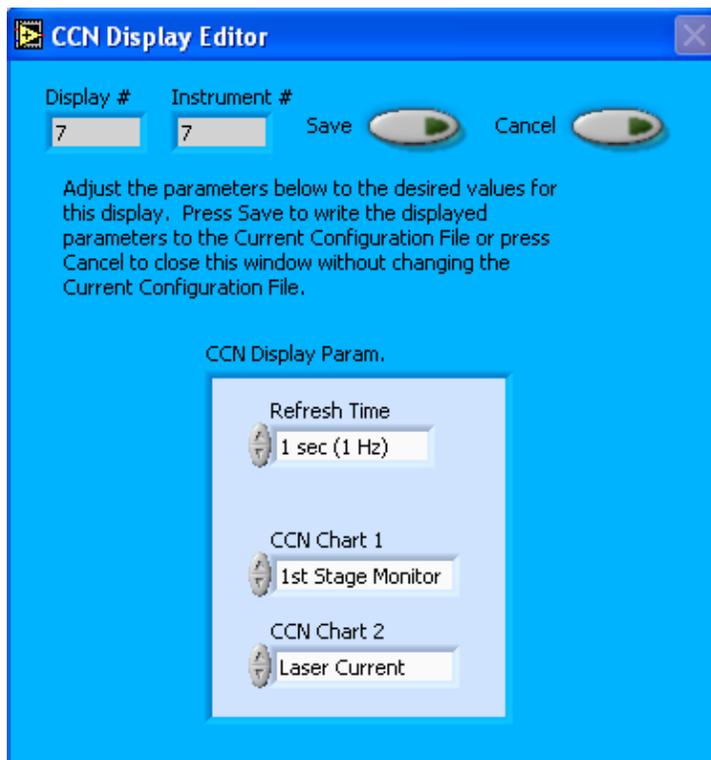

Figure 2: CCN Display Editor Window

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 CCN Display Parameter box at the bottom of the window also allows you to configure the channels on the CCN'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 CCN Window

The different parts of the CCN 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 Data

The CCN channels are displayed in the data window at the upper left of the CCN tab. These data are specific to the time listed in the upper-right of the PADS window.

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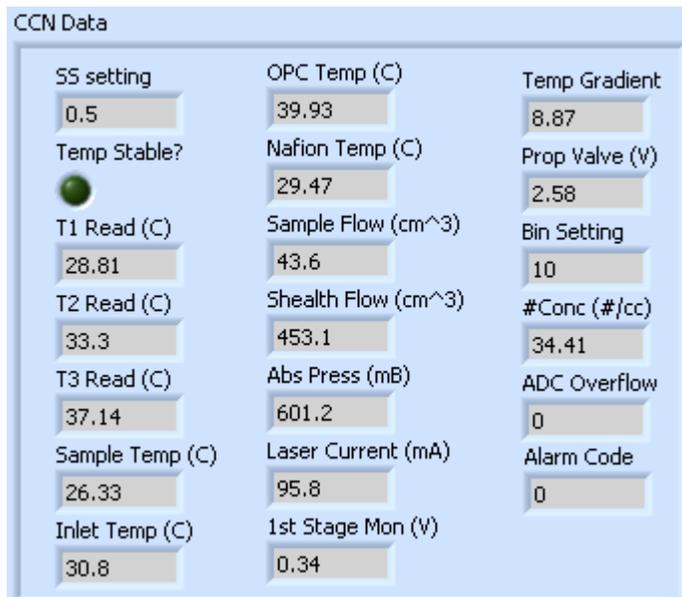

Figure 3: CCN Data Window

Note that sample and sheath flow are labeled with cm^3 units, although these channels are really given in cm^3/min. This is a known bug that will be fixed in an upcoming version of PADS.

Histogram Data Window

Figure 4 shows the histogram display of CCN-acquired particle data. Like the channel data display, the histogram shows time-specific data.
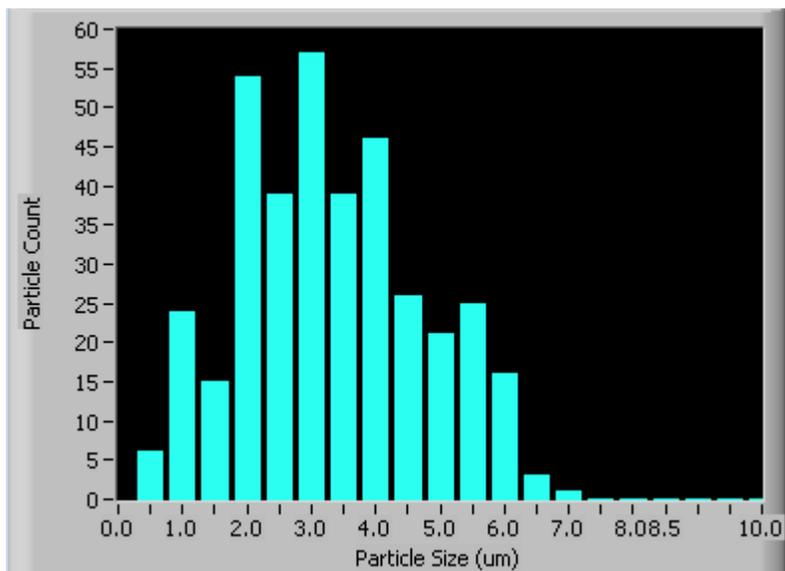
Figure 4: CCN Histogram Display

The [Plot 0] button to the upper right of the histogram allows you to change the appearance of the histogram display. Click on the button to bring up a drop-down list of available options.

Right-clicking on the histogram itself will also show you options for scaling and copying data. For more information, see the discussion of time-series charts in the "Chart Displays" section.

Chart Displays

The CCN chart displays consist of a tab with three standard time-series charts and a tab with two selectable charts. Figure 5 shows these tabs and the standard time-series charts.

Figure 5: CCN Standard Time-Series Charts

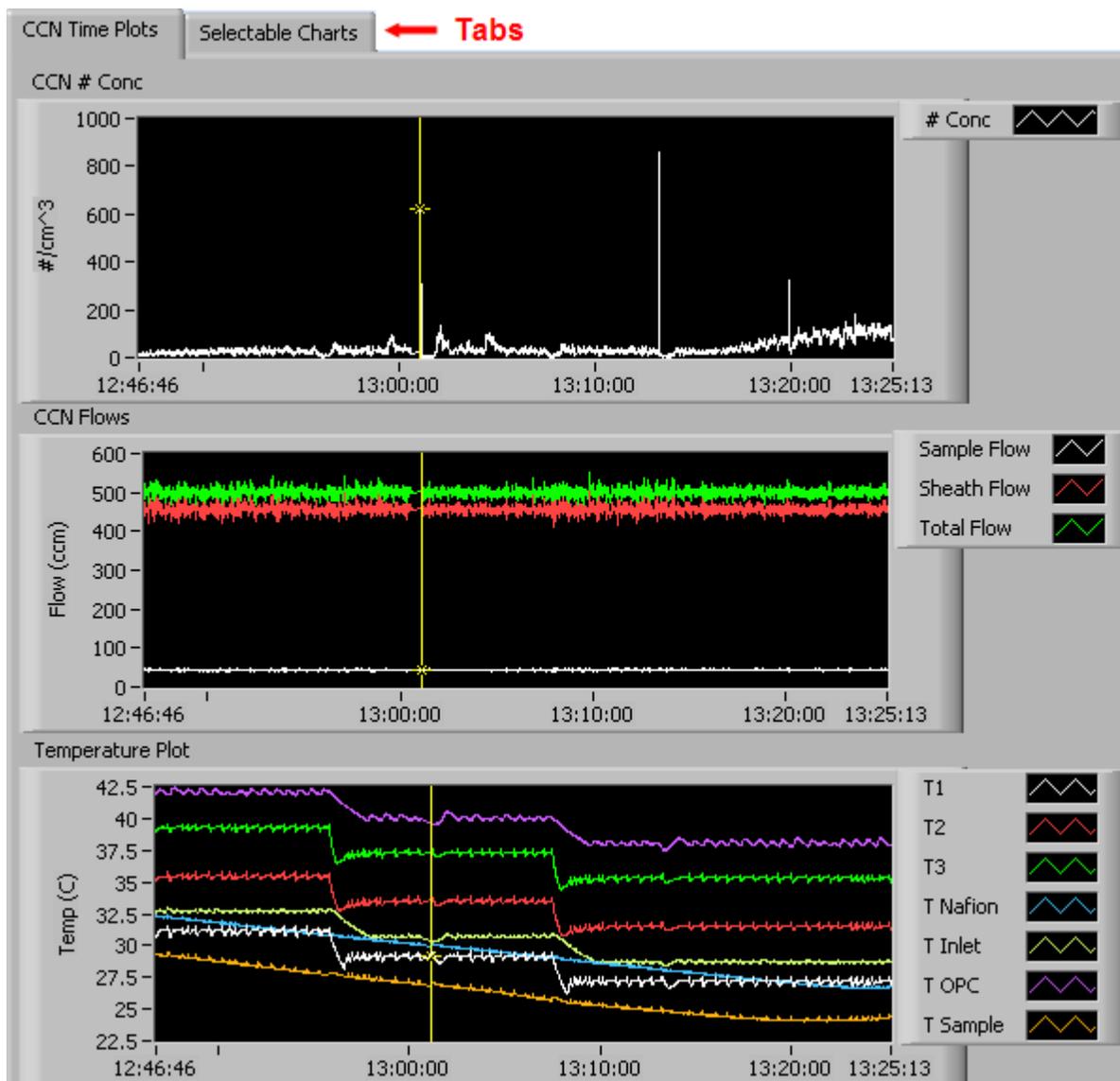When you access time-series charts in playback mode, the currently selected moment in time is indicated by a yellow cursor, as shown above. The y-axis value for this time is indicated by cross (+) on this cursor. Note that when you display a large range of time-series data, the chart display does not 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 13:00:00, you simply select the field that currently says 13:25:13, type in 13:00:00, 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, 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.

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

1. CCN # Conc, Flows, and Temperature Data

The three charts on the first tab graph key CCN data with respect to time. The top chart displays particle number concentration ($\#/cm^3$). The middle chart displays sample flow, sheath flow, and total flow (all in ccm). The bottom chart displays various temperature data. For definitions of these channels, see *Appendix A* in the *PADS Operator Manual*.

In playback mode, you can zoom in or out by using the time controls. In acquisition mode, use the "Display Range" control to zoom in or out. The buttons to the right of the charts that look like this allow you to manipulate the chart display.

2. Selectable Charts

The **CCN 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 **CCN 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.

Appendix A: CCN Channels

A list of CCN channels appears below. The CCN 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 CCN Selectable Charts tab.

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

Time	ADC overflow
Hours	Bin 1
Minutes	Bin 2
Seconds	Bin 3
SS setting	Bin 4
Temp Stable?	Bin 5
T1 read (C)	Bin 6
T2 read (C)	Bin 7
T3 read	Bin 8
Sample Temp	Bin 9
T inlet (C)	Bin 10
T OPC (C)	Bin 11
T Nafion (C)	Bin 12
Sample flow (ccm)	Bin 13
Sheath flow (ccm)	Bin 14
Abs Press (mb)	Bin 15
Laser Current (mA)	Bin 16
1st Stage Monitor	Bin 17
Temp. Gradient (C)	Bin 18
Prop. Valve (V)	Bin 19
Alarm Code	Bin 20
Bin setting	CCN Status
# Conc	GPS Time

CCN 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 CCN data. It is given in seconds after midnight on the day the program was started. Hours, Minutes, and Seconds are generated by the CCN computer clock. They give the time in seconds after midnight when the CCN sends the data. GPS Time is included in every instrument's list of channels whenever a GPS is included as one of the PADS instruments. GPS Time is collected from

an instrument other than the CCN, even though it appears as a channel in the CCN output file.

Bin Channels: Channels labeled Bin [*i*] store data on the number of particles of different sizes that the CCN has detected. These data are used in the histogram display.

Housekeeping channels: The CCN has 16 A/D housekeeping channels that measure a 0-5 V value from one of the instrument's internal sensors, for example a pressure or temperature sensor, and then convert this voltage to a binary value from 0 to 4095. These housekeeping channels often store information about the health of the instrument. In the list above, housekeeping channels are denoted in italics.

Statistical Channels: ADC Overflow stores the number of oversized particles the probe has detected. SS Setting and Bin Setting store information about the CCN's configuration. In a future version of PADS, CCN Status will store information on the communication between the probe and PADS. Currently, the channel is non-functional.

Calculated Channel: # Conc stores the result of a concentration calculation the CCN computer has performed.