Particle Analysis and Display System (PADS):
Cloud Imaging Probe Grayscale (CIP GS) Module

Operator Manual

DOC-0182 Rev A-4, PADS 2.5.6

CIP Grayscale Module 2.6.11

DROPLET MEASUREMENT TECHNOLOGIES

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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 Imaging Probe Grayscale (CIP GS).

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 CIP GS module are also described in the *PADS Operator Manual*.

Note that in addition to the standard instrument output file, PADS generates a secondary output file for the CIP GS. This file is archaic and will no longer be created in upcoming versions of PADS. It has "cal" appended to its name to distinguish it from the primary CIP GS output file.

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 CIP GS

Your CIP GS 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 "CIP GS" tab.

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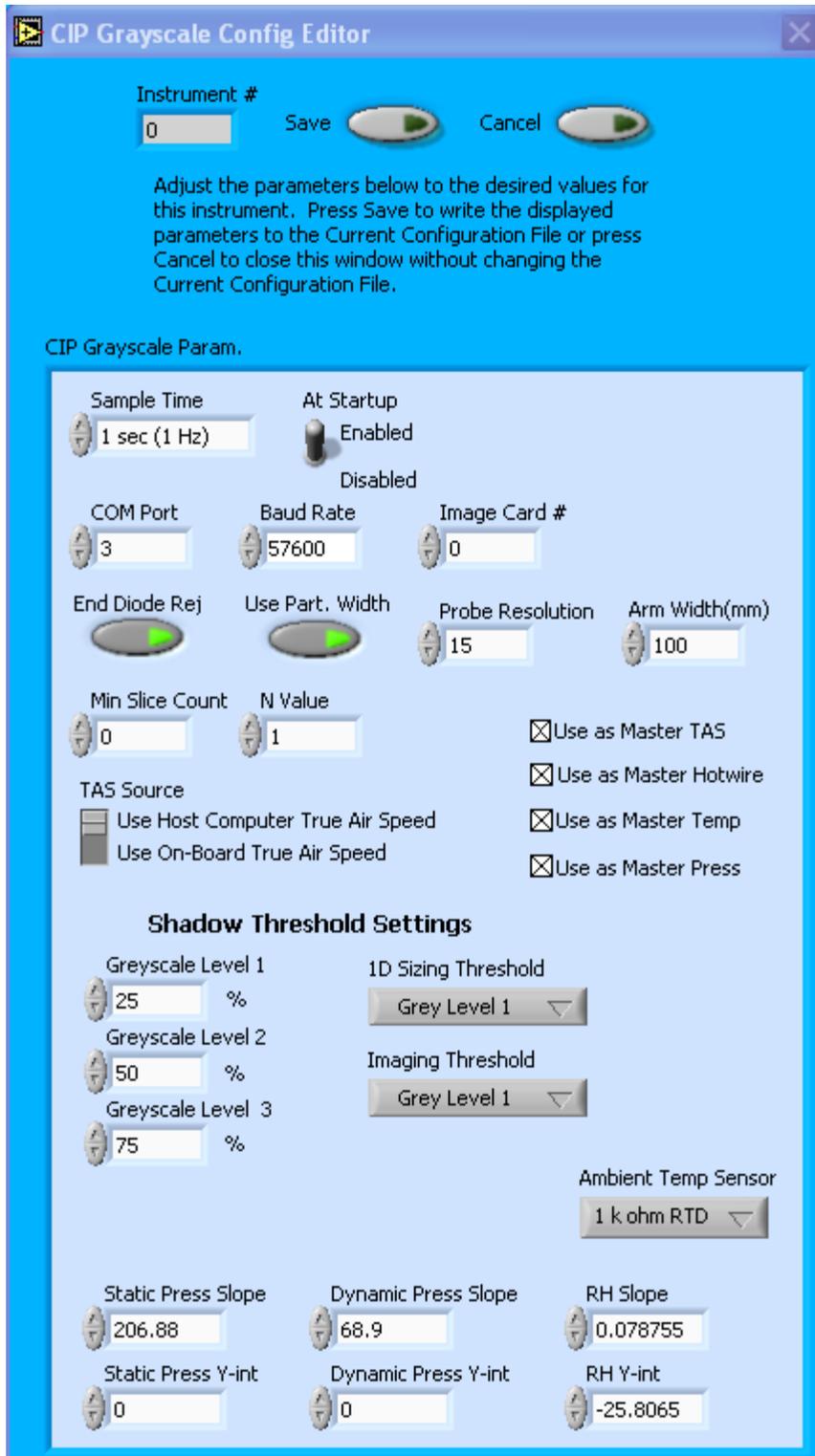
Figure 1: CIP Grayscale Configuration Editor Window

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

4. When you are done configuring the CIP GS 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 CIP GS Parameters

Sample Time: This parameter shows the time interval you'd like between samples. 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). A value of one is recommended, as described in the warning below. Note that if you increase the sample time, you will still collect data for the same number of particles. This is because the probe collects data continuously and relays cumulative data at each sampling interval. For example, say you have the sample time set to .5 seconds. You might see four particles of size 25 μm during the first sample, and five particles of this size during the second sample. If you had set your sample time to one second instead of .5 seconds, you would instead get one sample that showed nine particles of size 25 μm.

WARNING: One hertz sampling is currently recommended, as choosing other values will invalidate time-dependent PADS calculations like number concentration, volume concentration, and LWC on optical probes. (ED and MVD are not affected.) This is a known bug in PADS that will be fixed in an upcoming version of the program.

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

COM Port: This is the serial communications port that the CIP GS 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.

Image Card #:   This is the communications port that the CIP GS uses to relay image data to the computer. The image card serial port differs from a standard serial port and can communicate data at higher speeds. If you have multiple instruments transmitting image data, the Image Card # tells you which port is being used by the current instrument, in this case the CIP GS. As with the Com Port parameter, you may need to change this if you are running PADS in data-acquisition mode on different computers.

End Diode Reject: Activating this button instructs the CIP GS to reject any particles for sizing that obscure an end diode. (Particles that obscure both end diodes are always rejected.) Particles that obscure one end diode usually extend outside the probe area, invalidating any size reading. Thus it often makes sense to exclude them from sizing.

If **End Diode Reject** is enabled, images of these particles are still recorded, and you can still do some sizing of these particles in post-processing. However, they won't be included in the on-board histogram analysis. If **End Diode Reject** is disabled, particles that obscure only one end diode will be sized, albeit incorrectly.

Note that if you want to measure very large particles, you may want to disable both **End Diode Reject** and **Use Part. Width.** See explanation below.

Use Part. Width: Activating this button instructs the CIP GS to use particle width to size particles for creating the 1D histogram. Particle width is the dimension parallel to the diode array. The other sizing option is to use particle length, which is the dimension perpendicular to the diode array. The default setting for this button is "On," since particle width is generally preferred to particle length as a sizing criterion. This is because length measurements depend on particle velocity and may be distorted if the air speed clock is set incorrectly. However, particles that are wider than the diode array may not be measurable unless the CIP GS measures their length rather than their width. These particles would block one end of the diode array, making it impossible to estimate their width. However, if you turn off **End Diode Reject** (which means the particle will get sized) and disable **Use Part. Width**, the CIP GS will record information about the particle's length and the width that was captured by the diode array. You can then use this information in post-processing to estimate the particle's size.

Min Slice Count: By setting the minimum slice count parameter, you can instruct PADS to store images only of larger particles. The probe will not retain any images of particles smaller than the minimum slice count. Each slice has a width of the probe resolution, so a minimum slice count of four on a CIP GS with 25 µm-resolution means that particles smaller than 100 µm will not be saved as images. Setting the value to zero means that all images will be recorded. Raising the minimum slice count helps conserve storage space on the computer disk and in very high concentrations will also prevent losing information due to limitations related

to transmission bandwidth. Note that particles that are not saved as images will still be sized and used to create the 1D size distributions that are transmitted at a constant rate to the computer from the probe. It is recommended that this parameter be set to zero in most cases unless you are operating the system in an environment where concentrations are extremely high, such as in sprays, where the number concentration can exceed several thousand per liter.

N Value: This parameter determines what fraction of particle images get saved. Its default is one, meaning that all images are saved. Increasing the value decreases the number of images by a factor of N. So if N = 3, PADS will only save every third image. Raising the N value helps conserve disk storage space and limits transmission losses. Unless disk space is an issue, it is recommended that all images are saved.

TAS Source: This switch sets the source for true air speed that is used for controlling the rate at which images are sampled. The optimum rate will be one sample taken each time a particle moves across the array by one resolution step. For example, for a 25-µm resolution CIP GS, if the air is moving at a velocity of 100 m/sec, the image would be sampled once every 250 nanoseconds, or 25×10^{-8} seconds. This insures that the recorded images are not artificially elongated (over-sampled) or truncated (under-sampled).

Setting the value to "Use Host Control Air Speed" tells the probe to use the host computer's version of TAS. (The host computer's source for the TAS reading is in turn set in the Setup tab.) Setting the slide control to "Use On-Board True Air Speed" tells the probe to use its own internal measurement of TAS for clocking. Normally, the "Use Host Control Air Speed" is selected, since this is the airspeed computed from the pitot measurements of one of the probes and is most representative of the particle velocity at the point of measurement.

Note that the TAS source set in the CIP GS Config Editor window is only used to clock the probe. For calculations that use TAS, PADS uses the source set in the Setup window.

For on-the-ground data collection, TAS Source should be set to "Use Host Control Air Speed." On the Setup window, the TAS source should then be set to "Manual" and an appropriate value chosen, e.g. 25 m/sec if the instrument is using spinning glass disks.

Shadow Threshold Settings

Grayscale Level 1 – 3: When a particle passes through the laser of the CIP GS and partially obscures one or more of the photodetectors in the diode array, Grayscale Level [*x*] determines what percentage decrease in the intensity of laser will be registered as an image shadow at a

level x (1, 2 or 3). These thresholds are used in the display of the images, as shown in Figure 6, and in subsequent data processing to determine how close a particle is to the center of focus. The greater percentage decrease in incident light level, the closer a particle is to the center of focus.

Example: Say you set Grayscale Level One to 25%, Grayscale Level Two to 50%, and Grayscale Level Three to 75%. A diode that has only 10% of the incident light obscured will not register a shadow event. A diode that has 30% of its light obscured will register a level 1 shadow event. A diode with 55% of its light obscured will register a level 2 event, while a diode with 90% obscuration will register a level 3hree event.

You can specify grayscale levels either by typing a percentage in the window or by using the arrow button to the left of the window. Level One must be the lowest value and Level Three the highest; if you change this order, PADS will display an "Invalid Grayscale Levels" error message in the upper right of the Config Editor window, and you will not be able to save your changes. It is also recommended that you have at least a 20% variation between grayscale levels in order to maintain data quality. If levels are set together too closely, the variation between them is likely due to noise rather than actual differences in particle shadowing.

1D Sizing Threshold: This is the minimum grayscale threshold a particle must reach in order to be sized. For instance, if you set 1D Sizing Threshold to Level Three, particles registering Level One and Level Two will not get sized. PADS will only image particles that have Level Three segments. *Note:* It is recommended that you set this threshold to a level corresponding to a 50% grayscale setting, since standard practice in the atmospheric sciences is to size particles that obscure 50% or more of a diode's light.

Imaging Threshold: This is the minimum grayscale threshold a particle must reach in order for that particle to be recorded as an image. For instance, if you set this threshold to Level Three, particles only registering at Levels One and Two will not be recorded. PADS will only image particles that include Level Three segments.

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

Rarely Reconfigured CIP GS Parameters

The CIP GS 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 CIP GS. If your CIP GS 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.

Probe Resolution: This parameter indicates your probe's resolution in microns (µm). Because this was set at the time of manufacturing, you should not need to modify this parameter. In fact, doing so may compromise your data. This is because PADS uses the Probe Resolution number specified on the CIP GS Config Editor window to determine particle size and sample volume.

CIP GS probes may be set to 15, 25, 50, or 100 µm. 15 µm is the highest resolution, and 100 the lowest. The probe resolution is the width of space that gets imaged onto one CIP GS diode.

Arm Width (mm): The distance between the probe's arms along which the laser travels. This value is used in calculating particle concentrations. (See the "Sample Volume" entry in the *PADS Operator Manual's Appendix A: Definitions* for details.) The arm width of your probe should not change. This parameter is only used in sample volume calculations.

Use as Master TAS: When checked, this checkbox tells PADS to use the CIP GS as the default TAS Source on the Setup window.

Note that there are three different parameters related to TAS source:

1.) The "TAS Source" slide control on the Config Editor screen

2.) The "Use as Master TAS" checkbox on the Config Editor screen

3.) The "TAS Source" drop-down list on the Setup Screen

#2 and #3 determine the global TAS that PADS uses in calculations. If #2 is checked on the CIP GS Config Editor screen, then the CIP GS will be the default TAS Source listed in #3. You can override this choice by changing the value of #3.

#1, in contrast, is used not in calculations but in clocking the probe.

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. This setting should not change unless you are using a spinning disk for testing or calibration, in which case the TAS Source parameter on the Setup screen should be set to "Manual."

Use as Master Hotwire: When checked, this box tells PADS to use the CIP GS'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 GS. In a CAPS system, the Hotwire signal is usually measured by the CAS, so the CAS and not the CIP GS should be set to Use as Master Hotwire for these systems.

Use as Master Temp: When checked, this box tells PADS to use the CIP GS'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 CIP GS'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.

Static Press Slope: This is the slope used in the linear function to derive static pressure from the voltage output of the static pressure transducer, as follows:

$$Static\ Pressure = \textbf{\textit{(Static Press Slope)}} * (Voltage) + Static\ Press\ Y\text{-}int$$

Static Press Slope is a calibration coefficient measured by DMT and specific to your transducer. It assumes a 5-volt sensor range that is electronically multiplied by 2 before going to a 0-10 volt analog-to-digital converter. Do not change this parameter without consulting DMT first.

Static Press Y-int: This is the intercept term used in the linear function to derive static pressure from the voltage output of the static pressure transducer, as follows:

$$Static\ Pressure = (Static\ Press\ Slope) * (Voltage) + \textbf{\textit{Static Press Y-int}}$$

Static Press Y-int is a calibration coefficient measured by DMT and specific to your transducer. It assumes a 5-volt sensor range that is electronically multiplied by 2 before going to a 0-10 volt analog-to-digital converter. Do not change this parameter without consulting DMT first.

Dynamic Press Slope: This is the slope used in the linear function to derive dynamic pressure from the voltage output of the dynamic pressure transducer, as follows:

$$Dynamic\ Pressure = \textbf{\textit{(Dynamic Press Slope)}} * (Voltage) + Dynamic\ Press\ Y\text{-}int$$

Dynamic Press Slope is a calibration coefficient measured by DMT and specific to your transducer. It assumes a 5-volt sensor range that is electronically multiplied by 2 before going to a 0-10 volt analog-to-digital converter. Do not change this parameter without consulting DMT first.

Dynamic Press Y-int: This is the intercept term used in the linear function to derive dynamic pressure from the voltage output of the dynamic pressure transducer, as follows:

$$Dynamic\ Pressure = (Dynamic\ Press\ Slope) * (Voltage) + \textbf{\textit{Dynamic Press Y-int}}$$

Dynamic Press Y-int is a calibration coefficient measured by DMT and specific to your transducer. It assumes a 5-volt sensor range that is electronically multiplied by 2 before going to a 0-10 volt analog-to-digital converter. Do not change this parameter without consulting DMT first.

RH Slope: This is the relative humidity (RH) slope used in the linear function to derive relative humidity from a relative humidity sensor, as follows:

*RH = (RH Slope) * (bits) + RH Offset*

RH Slope is a calibration coefficient measured by the sensor's manufacturer. Do not change this parameter without consulting DMT first.

RH Offset (called **RH Y-int** on some instrument screens)**:**   This is the intercept term used in the linear function to derive relative humidity from a relative humidity sensor, as follows:

*RH = (RH Slope) * (bits) + **RH Offset***

RH Offset is a calibration coefficient measured by the sensor's manufacturer. Do not change this parameter without consulting DMT first.

Ambient Temp Sensor: This control tells PADS what kind of temperature sensor is installed in the CIP GS. It is pre-configured to match the temperature sensor on your particular probe and should not 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.

Configuring the CIP GS Display

To configure the CIP GS display, go to the **Configure** menu from the CIP GS tab and select **Configure Display.** This will bring up the following window.
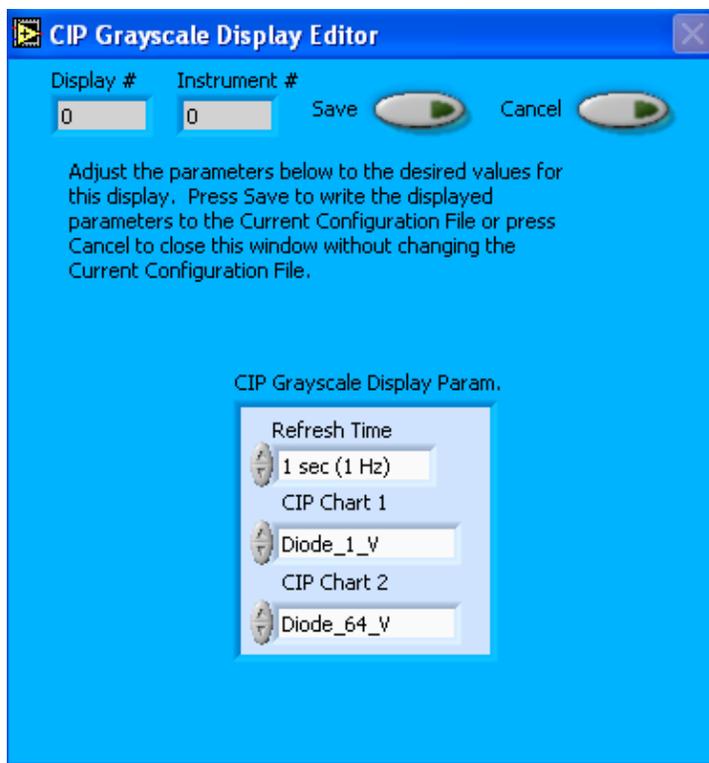
Figure 2: CIP Grayscale Display Editor Window

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

The following sections describe the different sections of the CIP GS Window: the channel tabs, the histogram data, and the chart displays.

The different parts of the CIP GS 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 CIP GS channel data section has three tabs at the top: CIP GS Data, CIP GS Housekeeping, and CIP GS Cal (Calibration). The CIP GS Data window is shown below.

Figure 3: CIP GS Data Window
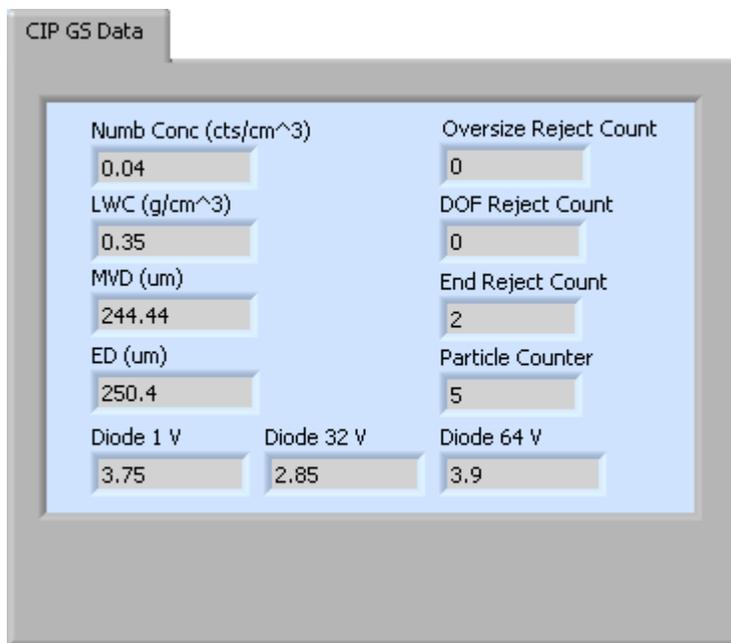
The CIP GS Data tab displays commonly used channels. The CIP GS Housekeeping tab shows channels that indicate whether the instrument is functioning properly. The CIP GS (Calibration) tab shows channels that are used during instrument calibration. Note that some channels appear on several tabs—for instance, Laser Current (mA) appears on both the Housekeeping and CIP GS (Calibration) tabs.

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

Histogram Data Window

Below the channel tabs is the histogram display of CIP GS-acquired particle data, as shown in Figure 4. Like the channel data display, the histogram shows time-specific data.
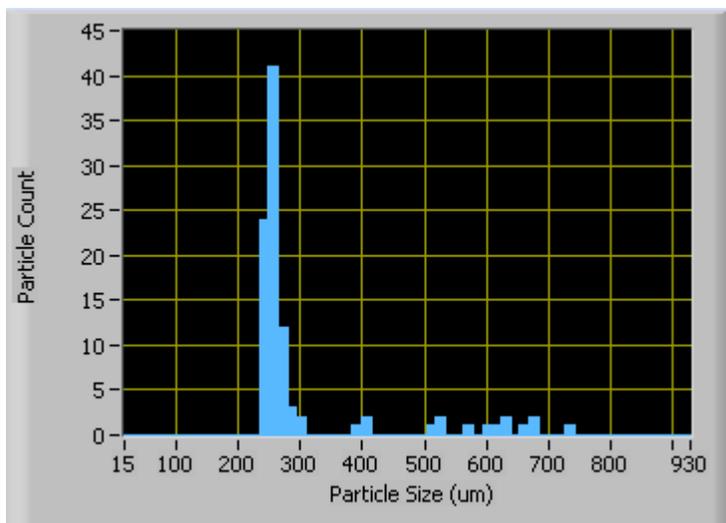

Figure 4: CIP GS Histogram Window

The histogram shows the number of particles counted in a given size range. In the example above, CIP GS has detected 41 particles of approximate size 260 µm at the time shown.

Note that each size shown in the histogram's x-axis actually refers to a size interval that spans 15 µm. This is because these data were generated with a 15 µm-resolution CIP GS, as can be inferred from the fact that the first label on the x-axis is at 15 µm.

Warning: It is recommended that you leave **1 D Sizing Threshold** set to 50%. Changing it from this value affects how the probe sizes particles and will make the data inconsistent with standard sizing methods.

To view a larger histogram, click on the **Full Hist.** tab in the Chart Displays section described below.

Chart Displays

PADS organizes the CIP GS chart displays using five tabs. You can access the charts by selecting these tabs, which are shown in the following figure.
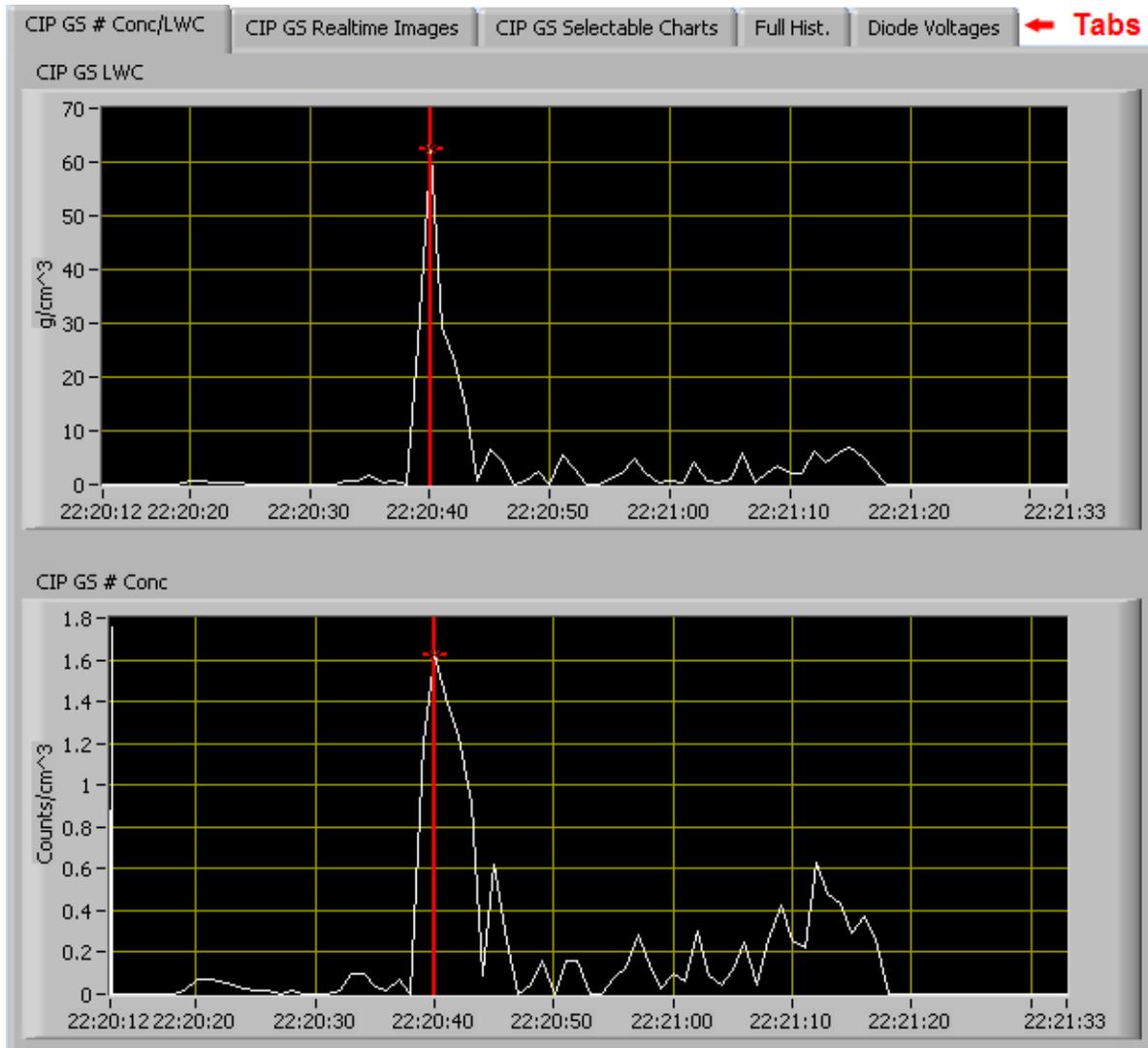
Figure 5: CIP GS Chart Tabs

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 22:21:00, you simply select the field that currently says 22:21:33, type in 22:21:00, 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. CIP GS # Conc/LWC Tab

The two graphs on the first tab, **CIP GS # Conc/LWC**, plot LWC (g/m^3) and particle concentration (#/cm^3) as a function of time. In playback mode, you can zoom in or out by using the time controls.

2. CIP GS Realtime Images

The **CIP GS Realtime Images** tab shows two-dimensional images of particles, as shown in Figure 6. Images are only available during acquisition mode. The Realtime Images tab is

inactive in playback mode. For viewing particles in playback mode, use the PADS Integrated Image Playback System.
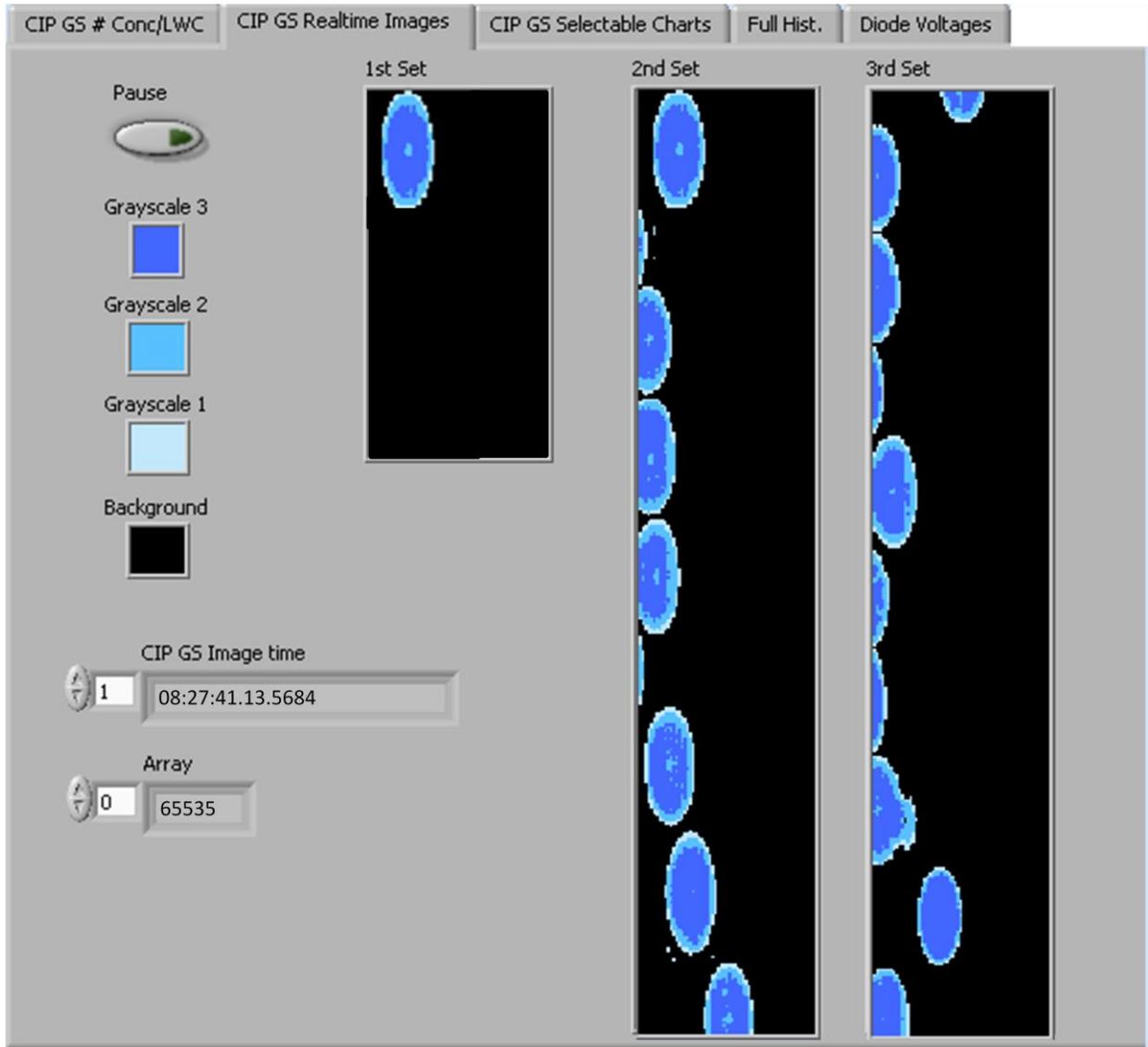

Figure 6: CIP GS Realtime Images Window

Images are shown for the current point in time unless you press pause, at which point the images freeze. **CIP GS Image Time** indicates the time at which the particles were imaged. **Array** is a parameter reserved for internal system use. The "1st Set" window displays the first particle from the 2nd Set.

3. CIP GS Selectable Charts

The **CIP GS 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 **CIP GS 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.

4. Full Histogram

The **Full Hist** tab shows a larger version of the histogram in the bottom left of the CIP GS screen. This histogram also allows you to manipulate the display using the controls and features described below.

Autoscale Buttons

The Autoscale controls, Autoscale X and Autoscale Y, let you control how the x and y scales are set. If you enable autoscaling, PADS will automatically select an appropriate scale with which to display the current data. For instance, if the probe is not currently detecting many particles, the y-axis range will decrease. On the other hand, if you disable autoscaling, the scale of the axes will remain constant. In this case, the range will always be the same as it was when autoscaling was disabled. The minimum and maximum Y values can then be changed manually by typing new numbers into these fields. *In playback mode, autoscaling will not take effect until you change the time using the time controls.*

Note that the Autoscale Y button overrides the Autoscale Y option in the drop-down menu that appears when you right-click on the chart.

Log-Scale Button

When you turn on the Log-Scale button, PADS scales the y-axis logarithmically rather than linearly. Autoscaling can be enabled or disabled with this option.
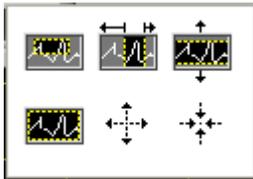
The Graph Tools Buttons

The graph tools buttons look like this:

The left button currently does not have functionality.

The right button allows you to move the histogram display around in the window.

Clicking on the middle button brings up the zoom window, which looks like this:

Before using the zoom controls, turn off autoscaling so your scaling changes stay in effect when new data are displayed.

Selecting the icon on the upper left allows you to select data on the histogram screen and magnify it. This changes both the x and y axes.

Selecting the button on the upper middle allows you to select a horizontal range of data you'd like magnified. This will change the x axis but not the y axis.

Selecting the button on the upper right allows you to select a vertical range of data you'd like to see magnified. This will change the y axis but not the x axis.

Selecting the button on the bottom left sets the axis to the same limit autoscaling would use. Autoscaling is not enabled, however, so when the data change, the axis limit stays constant.

Selecting the button on the bottom middle allows you to zoom in on a target.

Selecting the button on the bottom right allows you to zoom out on a target.

5. *Diode Voltages*

The diode voltages chart displays the peak illumination ("fully illuminated") and dark current voltages for each diode on the CIP GS. Because dark current voltages are constant

for the entire sampling instance, these values do not change. The peak illumination voltages vary with time.

You can autoscale data and/or scale data logarithmically by pressing the buttons at the top of the Diode Voltages tab. The graph tools button gives you options for zooming and for panning around in the window (see the "Full Hist." section). By right-clicking on the legend in the upper right of the tab, you can select options for changing the appearance of the graph.

Appendix A: CIP GS Channels

A list of CIP GS channels appears below. The CIP GS output file will contain data values for each channel for each sampling instance. For definitions of the channels, consult *Appendix A: Definitions* in the PADS Operator Manual. Channels that start with "CIP_GS" are the CIP GS's results for channels that are often calculated by several instruments. For these definitions, look under the more general term in the *PADS Operator Manual*. For instance, for the definition of CIP_GS_ED, see "ED" in the main manual. CIP_GS_Numb refers to the CIP GS's Number Concentration.

Time	Bin_29	Bin_59
Over_rej_count	Bin_30	Bin_60
Bin_1	Bin_31	Bin_61
Bin_2	Bin_32	Bin_62
Bin_3	Bin_33	DOF_rej_counts
Bin_4	Bin_34	End_rej_counts
Bin_5	Bin_35	Laser_Temp(C)
Bin_6	Bin_36	Spare
Bin_7	Bin_37	Diode_1_V
Bin_8	Bin_38	Diode_32_V
Bin_9	Bin_39	Diode_64_V
Bin_10	Bin_40	Press_Temp(C)
Bin_11	Bin_41	Dynamic_Press(mBar)
Bin_12	Bin_42	Static_Press(mBar)
Bin_13	Bin_43	8_Volts(V)
Bin_14	Bin_44	V_ref_1.24(V)
Bin_15	Bin_45	Board_Temp(C)
Bin_16	Bin_46	Laser_Current(mA)
Bin_17	Bin_47	LWC(V)
Bin_18	Bin_48	LWC_Slave(V)
Bin_19	Bin_49	RH%
Bin_20	Bin_50	Ambient_Temp(C)
Bin_21	Bin_51	Particle_counter
Bin_22	Bin_52	Seconds
Bin_23	Bin_53	Milliseconds
Bin_24	Bin_54	Hours
Bin_25	Bin_55	Minutes
Bin_26	Bin_56	Host_Sync_Counter
Bin_27	Bin_57	Reset_Flag
Bin_28	Bin_58	Instant_Illum_1

Instant_Illum_2	Instant_Illum_43	Dark_Current_20
Instant_Illum_3	Instant_Illum_44	Dark_Current_21
Instant_Illum_4	Instant_Illum_45	Dark_Current_22
Instant_Illum_5	Instant_Illum_46	Dark_Current_23
Instant_Illum_6	Instant_Illum_47	Dark_Current_24
Instant_Illum_7	Instant_Illum_48	Dark_Current_25
Instant_Illum_8	Instant_Illum_49	Dark_Current_26
Instant_Illum_9	Instant_Illum_50	Dark_Current_27
Instant_Illum_10	Instant_Illum_51	Dark_Current_28
Instant_Illum_11	Instant_Illum_52	Dark_Current_29
Instant_Illum_12	Instant_Illum_53	Dark_Current_30
Instant_Illum_13	Instant_Illum_54	Dark_Current_31
Instant_Illum_14	Instant_Illum_55	Dark_Current_32
Instant_Illum_15	Instant_Illum_56	Dark_Current_33
Instant_Illum_16	Instant_Illum_57	Dark_Current_34
Instant_Illum_17	Instant_Illum_58	Dark_Current_35
Instant_Illum_18	Instant_Illum_59	Dark_Current_36
Instant_Illum_19	Instant_Illum_60	Dark_Current_37
Instant_Illum_20	Instant_Illum_61	Dark_Current_38
Instant_Illum_21	Instant_Illum_62	Dark_Current_39
Instant_Illum_22	Instant_Illum_63	Dark_Current_40
Instant_Illum_23	Instant_Illum_64	Dark_Current_41
Instant_Illum_24	Dark_Current_1	Dark_Current_42
Instant_Illum_25	Dark_Current_2	Dark_Current_43
Instant_Illum_26	Dark_Current_3	Dark_Current_44
Instant_Illum_27	Dark_Current_4	Dark_Current_45
Instant_Illum_28	Dark_Current_5	Dark_Current_46
Instant_Illum_29	Dark_Current_6	Dark_Current_47
Instant_Illum_30	Dark_Current_7	Dark_Current_48
Instant_Illum_31	Dark_Current_8	Dark_Current_49
Instant_Illum_32	Dark_Current_9	Dark_Current_50
Instant_Illum_33	Dark_Current_10	Dark_Current_51
Instant_Illum_34	Dark_Current_11	Dark_Current_52
Instant_Illum_35	Dark_Current_12	Dark_Current_53
Instant_Illum_36	Dark_Current_13	Dark_Current_54
Instant_Illum_37	Dark_Current_14	Dark_Current_55
Instant_Illum_38	Dark_Current_15	Dark_Current_56
Instant_Illum_39	Dark_Current_16	Dark_Current_57
Instant_Illum_40	Dark_Current_17	Dark_Current_58
Instant_Illum_41	Dark_Current_18	Dark_Current_59
Instant_Illum_42	Dark_Current_19	Dark_Current_60

Dark_Current_61	True Air Speed	CIP_GS_ED
Dark_Current_62	CIP_GS_Numb	Status
Dark_Current_63	CIP_GS_LWC	GPS Time
Dark_Current_64	CIP_GS_MVD	

CIP GS channels fall into several broad categories:

Time Channels: Time, Hours, Minutes, Seconds, Milliseconds, and GPS Time store time data. Time is generated by the PADS computer clock and is the time when the program receives the CIP GS data. It is given in seconds after midnight on the day the program was started. Hours, Minutes, Seconds, and Milliseconds are times that the CIP GS clock generates when the probe collects data. (PADS sets the CIP GS clock, so although times are not perfectly synchronized, they are very close.) 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 CIP GS, even though it appears as a channel in the CIP GS output file.

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

Channels for Other Statistical Data: Over_rej_count, DOF_rej_counts, End_rej_counts, and Particle_counter store particle statistics collected by the CIP GS. Status stores statistical data the CIP GS has gathered on the communication between PADS and the probe.

Housekeeping Channels: The CIP GS has 16 A/D housekeeping channels that have a 0-10 V range measured by an A/D converter. Most channels have 12-bit converters that give integer values from 0 to 4095; however, Diode_1_V, Diode_32_V, and Diode_64_V have 6-bit converters that give binary values from 0 to 63.

Several of the housekeeping channels store data that indicate whether the probe is functioning properly. A list of these housekeeping channels is given below.

Laser_Temp(C)	*Diode_64_V*	*8_Volts(V)*	*LWC(V)*
Spare	*Press_Temp(C)*	*V_ref_1.24(V)*	*LWC_Slave(V)*
Diode_1_V	*Dynamic_Press(mBar)*	*Board_Temp(C)*	*RH%*
Diode_32_V	*Static_Press(mBar)*	*Laser_Current(mA)*	*Ambient_Temp(C)*

Diode Measurement Channels: Instant_Illum_[*i*] and Dark_Current_[*i*] store data for each channel on the CIP GS diode array.

Calculated Channels: CIP_GS_Numb, CIP_GS_LWC, CIP_GS_MVD, and CIP_GS_ED store the results of calculations PADS has performed on CIP particle data. True Air Speed stores the true air speed collected by the master TAS source designated on the PADS Setup screen.

Channels Reserved for Internal Use: These channels are reserved by the system; they include Host_Sync_Counter and Reset_Flag.