
Dynamic Threshold Feature For Cloud Droplet Probes (CDPs)

**DMT Technical Note
for CDPs manufactured after mid-2010
DOC-0258, Rev A**



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1.0 Background

In mid-2010, Droplet Measurement Technologies revised the Cloud Droplet Probe (CDP) firmware to implement a dynamic threshold feature. This feature automatically adjusts the instrument's sizer baseline to account for drifts due to temperature changes.

The dynamic threshold feature works as follows. The instrument's sizer signal voltage is digitized with a 12-bit ADC, which yields a 0 to 4095 count. A histogram is created of all counts between 0 and 512. (Signals above 512 are assumed to be responses to particles, and thus not relevant to establishing the baseline.) The system then identifies the narrowest band that contains at least 75% of counts in the histogram. This band, referred to as the "noise band," is the system's attempt to identify a range for baseline noise when no particles are present.

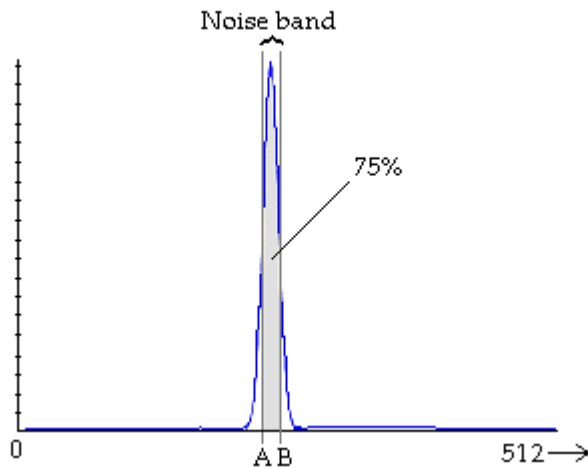


Figure 1: Identifying a Noise Band

If the noise band exceeds 20 counts (i.e., the width is too wide), or if no noise band was identified, the previous noise band is used. These qualifications are imposed in order to distinguish the noise from actual particle events. The instrument then uses the noise band to adjust the sizer baseline and identify particles. The noise band updates at a rate of 10 Hz.

2.0 Data Output

2.1 Instrument Output

CDPs with the dynamic threshold feature have two new channels included in their serial data output. These channels are highlighted in gray in the table below, which shows the CDP response to the SEND DATA command.

Byte	Parameter Description ¹
0	Laser Current / Housekeeping 1
1	
2	Dump Spot Monitor / Housekeeping 2
3	
4	Wingboard Temp / Housekeeping 3
5	
6	Laser Temp / Housekeeping 4
7	
8	Sizer Baseline / Housekeeping 5
9	
10	Qualifier Baseline / Housekeeping 6
11	
12	+5 V Monitor (V) / Housekeeping 7
13	
14	Control Board T (C) / Housekeeping 8
15	
16	Reject DOF
17	
18	
19	

¹ Note that older CDPs may not have their eight housekeeping channels set to measure default parameters such as laser current, dump spot monitor, wingboard temp and so on, or they may contain other defaults (laser photodiode monitor, wingboard ground, etc.)

Byte	Parameter Description ¹
20	Reject Average Transit
21	
22	
23	
24	Average Transit
25	
26	DT Bandwidth
27	
28	Dynamic Threshold
29	
30	ADC Overflow
31	
32	
33	
34	Bin 1 Counts
35	
36	
37	
38	Bin 2 Counts
39	
40	
41	
<i>...Bins 3 – 29 ...</i>	
150	Bin 30 Counts
151	
152	
153	
154	Checksum

DT Bandwidth is the width of the noise band—that is, [B - A] in Figure 1. **Dynamic Threshold** is the upper boundary of the noise band, i.e. B in Figure 1. Both of these channels are given in digital counts.

For definitions of other CDP output channels, see the *CDP Operator Manual (DOC-0029)*. CDPs with the particle-by-particle feature will have additional channels beyond those listed above, but these additional channels remain the same regardless of whether the unit has the dynamic threshold feature. Again, see the *CDP Operator Manual (DOC-0029)* for details.

2.2 Software Channels

The CDP and CDP-PBP modules of the Particle Analysis and Display System (PADS) as well as the Cloud Spectrometer and Impactor (CSI) software include **DT Bandwidth** and **Dynamic Threshold** in their output channels. These channels can be viewed from within the software, and their definitions are the same as those given in section 2.1.