

# MCA8000D OPTION PA INFORMATION AND INSTRUCTIONS FOR USE

## I. Option PA Information

Amptek's MCA8000D is a state-of-the-art, compact, high performance, digital Multichannel Analyzer (MCA). It replaces the discontinued MCA8000A, providing the same functionality with reduced dead time, modern communications interfaces (USB, RS-232, and Ethernet), and much higher data transfer rates.

The Option PA package has been developed to facilitate the use of the MCA8000D for particle counting in airborne (Size Calibration) and liquid suspended<sup>1</sup> (Number Calibration) particle applications. The unit is calibrated and certified traceable to the National Institute of Standards and Technology (NIST). The Option PA package is capable of detecting pulses from 5 mV to 10 V.

The MCA8000D is typically connected to the output of a particle sensor. It detects and displays a spectrum of pulse heights allowing the user to determine if a given particle size is producing the correct voltage. The software included with the MCA provides information on the peak center (centroid and mean calculation) making it easy to determine if the peak is in the correct position. The unit is internally calibrated to convert the MCA channel scale to a mV scale. The calibration is automatically loaded when the DPPMCA software opens.

### Features & Specifications

- Pulse detection from 5 mV to 10 V
- 2 Voltage scales: 1 V and 10 V
- 100 k input impedance
- NIST Traceable calibration
- Certificate of calibration
- Absolute or first peak detection mode (see figure 1)
- Accurate to within 1% at 1 μs peaking time and longer.

The PA package is <sup>1</sup>Sommer, H.T. "IMPLEMENTING PARTICLE COUNTER CALIBRATION PER ISO 11171-1999." TEAM Service, Inc., P.O. Box 220, Merlin, OR 97532, (541)476-4744, HolgerTSo@aol.com Copyright Society of Automotive Engineers

## Absolute and First Peak Detection Modes

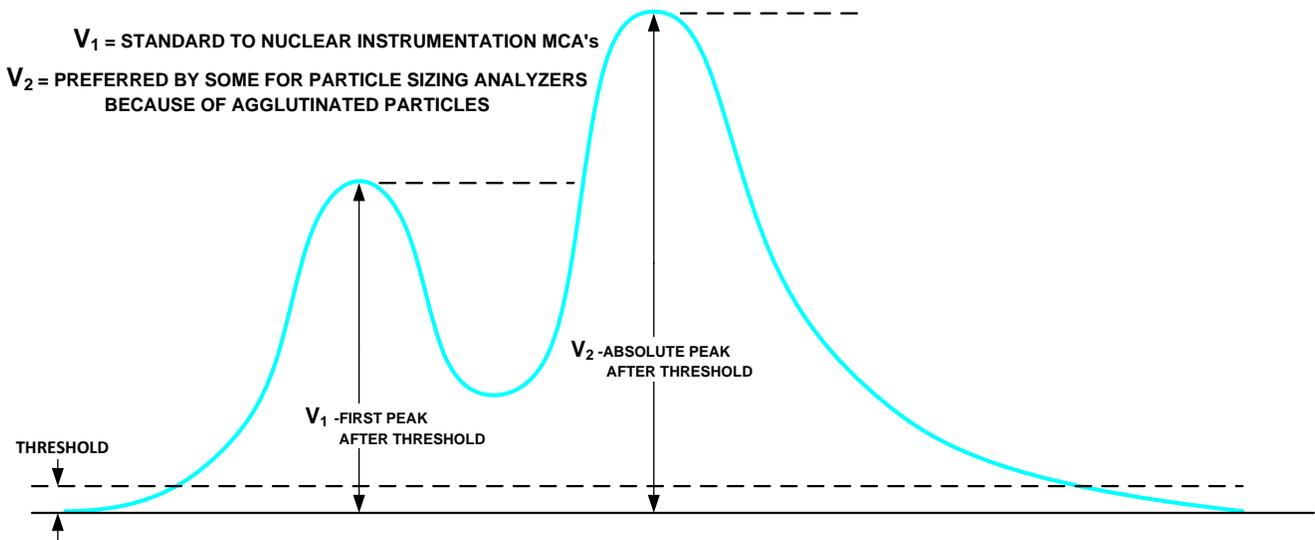
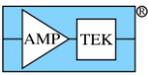


Figure 1. Absolute and first peak detection modes.

## MCA8000D Option PA Package NIST Traceable Certification

The MCA8000D Option PA package has been developed to facilitate the use of the MCA8000D for particle counting in airborne (Size Calibration) and liquid suspended (Number Calibration) particle applications. The unit is calibrated and certified traceable to the National Institute of Standards and Technology (NIST). A calibrated HP Multimeter 34401A is used to calibrate the MCA8000D Option PA. The following NIST numbers are applicable to



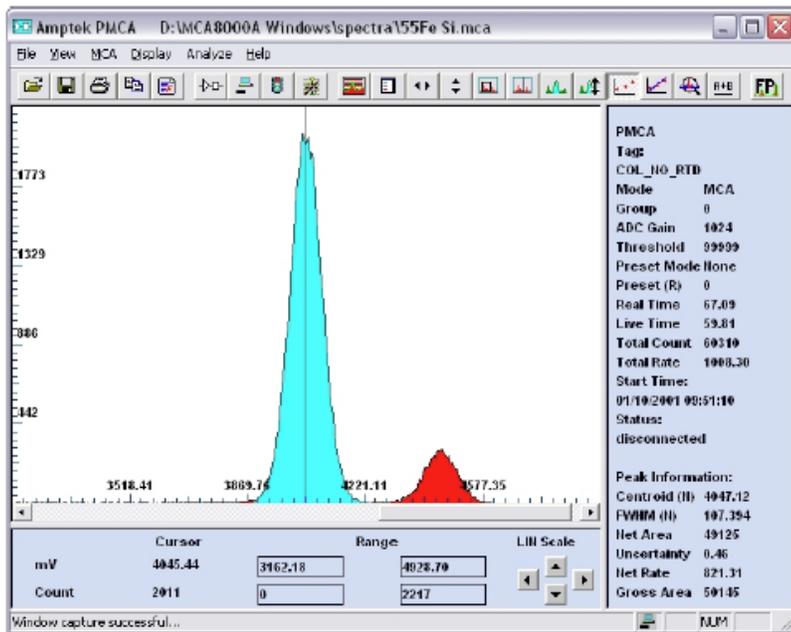
the HP Multimeter which is sent out for calibration once a year. If a copy of the multimeter certificate is required, please contact Amptek.

<b>Standard</b>	<b>NIST CERT #</b>
DC Voltage	VIA JOSEPHSON ARRAY
AC Voltage	266615
Resistance	270155
Frequency	VLF TRANSMISSION ON WWVB & LORAN C

The Option PA package is capable of detecting pulses from 5 mV to 10 V accurate to within 1% for an input pulse peaking time of 1  $\mu$ s or greater. The MCA8000D is designed to measure only the peak amplitude of an input pulse. It is not possible for an MCA8000D with the Option PA package to respond in any other way. The user can check the calibration at any time by injecting a calibrated pulse into the unit in accordance with procedure “MCA8000D OPTION PA Calibration Verification Procedure.” If the unit is found out of calibration (which is very rare), it should be sent to the factory.

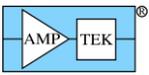
### Typical Implementation of the MCA8000D Option PA (Particle Counter Calibration)

In general, particle counters are calibrated by injecting a standard of a known particle size into the counter. The counter then produces output voltage pulses proportional to the size of the injected particles. The MCA8000D Option PA Multichannel Analyzer (connected to the amplifier output of the particle counter) takes these voltage pulses and bins them according to their amplitude. The software provided with the MCA then reads out this histogram of pulse heights and displays a spectrum. A typical spectrum is shown below.



In the example above, the large peak in blue has a centroid value of 4047 mV as read from the right hand panel under Peak Information. The centroid value should agree with the voltage that the know particle size should generate. For example, if a particle of size X microns is supposed to generate a 4000 mV pulse in the counter and the MCA reports 4047 mV as above, then the particle counter would have to be adjusted so that the MCA reports 4000 mV.

The Option PA package was designed specifically to facilitate the use of the MCA8000D for particle calibrations. The software automatically loads the mV calibration from the unit. The MCA is calibrated with NIST traceable equipment and a certificate of calibration is provided. All the necessary hardware and software are included in the package.



## MCA8000D Option PA Calibration

Unlike the discontinued MCA8000A, there are no calibration “files” for the MCA8000D Option PA. The calibration that converts channels to mV is stored inside of the MCA8000D and is automatically loaded when you connect to the DPPMCA software.

## MCA8000D Option PA Input Range Selection

- For pulses between 5 mV and 1 V use the 1 V input range.
- For pulses between 1 V and 10 V use the 10 V input range.

The input range is set in the DPP Configuration->MCA tab along with all of the MCA8000D acquisition parameters. Click  on the toolbar, press F9, or go to the DPP menu and select DPP Setup.

---

## II. Option PA Instructions for Use

### MCA8000D Connection Instructions

Use the USB cable to connect the MCA8000D USB connector to the PC’s USB connector. When using the USB connection the unit is powered through USB, the external +5V AC adapter is not needed.

**NOTE:** Grounding is critical to obtaining the best performance. We strongly recommend using a single point ground for the system. To ensure this, use a 3-prong to 2-prong adapter on the power supply of any notebook computer. This prevents the notebook from introducing another ground into the system.

### Quick Use of the MCA8000D Option PA

**NOTE:** The MCA8000D Option PA stores the calibration in firmware and automatically loads it into the DPPMCA software. When the input range is changed, the calibration automatically updates. This is different from the discontinued MCA8000A which required a calibration file to be read into the software on startup and for each voltage range. If you do not want the calibration to automatically load when DPPMCA is launched then go to the View menu->Preferences General tab and unselect “Use MCA8000D Option PA Calibration.”

1. Connect the MCA8000D and PC as described in the previous section.
2. Launch the DPPMCA software by opening the DPPMCA.exe file.
3. Connect to the MCA8000D
  - a. The connection dialog will appear when DPPMCA is launched.
  - b. Select which interface you will use (USB, Ethernet, or RS232).
  - c. If more than one device is available, select the device you want.
  - d. Click "connect."

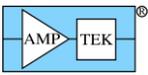
4. Configure the MCA8000D

The most commonly changed parameters are the low level discriminator (LLD) threshold and the input range (1 V or 10 V). It is recommended to keep the MCA8000D in 4096 channel mode as shipped from the factory. For all configuration parameters, click  on the toolbar, press F9, or go to the DPP menu and select DPP Setup. Once you have changed a parameter, click the "Apply" button to send it to the MCA8000D and then click OK.

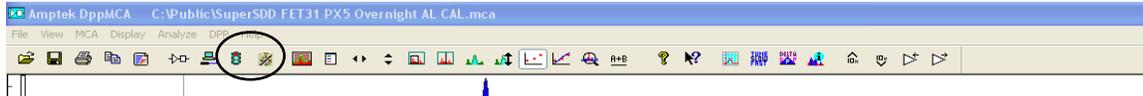
- To quickly change the LLD threshold click the cursor to the desired position and press F8. Then press the A key on the keyboard to clear the data.

5. Acquire data

- a. To start or stop acquisition, click the "start/stop" icon in the toolbar or press the space bar.



- b. To clear the data and time, click the "delete data and reset time" button in the toolbar or press "A" on the keyboard.

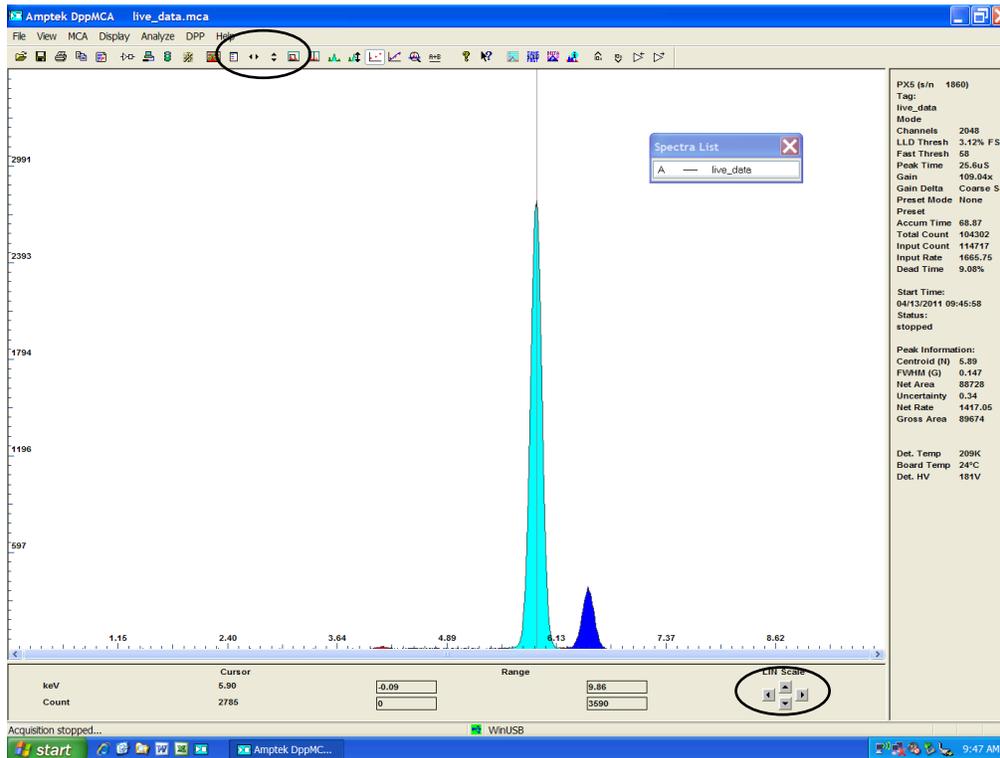


c. Data Acquisition Tips

- You can tell that data are being acquired if (a) the spectrum appears in the window, (b) the total counts are increasing, (c) the timers are increasing, and (d) the "status" in the right hand Info Panel reads "acquiring." The red light on the MCA8000D input panel will also be flashing.

6. Display data

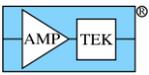
- a. The spectrum, counts, and accumulation time are automatically displayed as data are acquired. If a region of interest is defined and selected, its properties are also shown on the right hand info panel under Peak Information.
- b. To zoom in on a portion of the spectrum, use the arrows at lower right. To return to the full screen view, use the full range arrows on the toolbar.
- c. To toggle between a linear and a logarithmic vertical scale click on the spectrum and press "L" on the keyboard or select the scale from the Display menu.



7. Analyze data

a. Regions of Interest

- A Region of Interest (ROI) is an area marked as a potential peak in a spectrum.
- DPPMCA supports several ways to mark or define an ROI. The easiest way is to place the cursor at the left edge (lowest channel) of desired region and then press and hold the "U" key until the peak is highlighted and the upper edge is reached. You can also click on the Mark ROI button on the toolbar and then left-click and drag the cursor over the peak.
- For each ROI, DPPMCA computes the total counts (gross area), subtracts the background, and for the difference computes the net area, centroid, and peak width. The resolution is also displayed.



- For particle applications the median of the peak is often required. Go to the View menu-Preferences-Analysis tab and set the Centroid Calc. Method to Median (M). The centroid will now display Centroid (M) in the info panel under Peak Information.

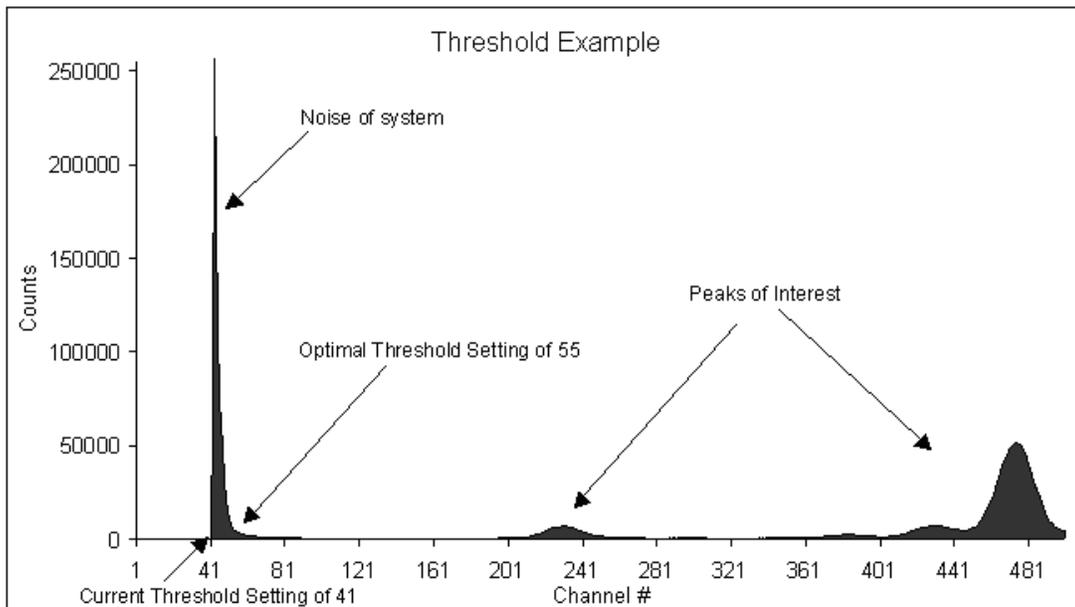
8. Save, load, and print data

- a. To save a data file, click the "File Save" icon or select Save As from the File menu. Data are saved in an ASCII file format with a .mca extension which includes the counts in each channel, slow and fast counts, ROI and calibration data, and the DPP configuration parameters. This file can be opened in notepad, Excel, etc.
- b. To load a saved data file use the "File Open" icon. The ROI and Calibration data from a stored file can be transferred to a spectrum being analyzed or can be automatically loaded when you open DPPMCA (View menu -> Preferences-> General Tab).
- c. To print a spectrum press "Ctrl-P" or the "Print" icon on the toolbar.

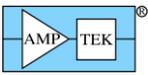
**NOTE: Setting the Threshold (MCA8000A vs. MCA8000D)**

Unlike the discontinued MCA8000A, the threshold setting is not critical in the MCA8000D. In the MCA8000A an incorrect threshold setting could reduce the count rate of the pulse of interest or show you no spectrum at all. With the MCA8000D you will always get the full throughput of the system and the threshold settings merely cuts the noise from appearing in the spectrum. In general, however, it is best to follow these common practices for setting the threshold.

The threshold should be set above the noise of the system. As a general rule, set it to 2 mV or higher. To set the threshold, move the cursor to the appropriate position above the noise and press F8 (F8 sets the threshold to the current cursor position). Begin and acquisition. If the noise still appears as in the example below, click the cursor higher and press F8 again. It is often helpful to set the display in Log mode for this procedure. Press L on the keyboard until the plot displays in Log.



In this example, the threshold was set at channel 41. This caused the large noise spike to be seen. An optimal setting would have been channel 55 which is after the large noise slope.



## Troubleshooting the DPPMCA Software

### If you cannot connect to the MCA8000D check the following:

- Was the software correctly installed?
- Were the drivers properly installed?
- Are all the cables connected?
- Use the AC adapter for troubleshooting

### If you start an acquisition but see no counts:

- Is there a signal at the input to the MCA8000D. Is the particle analyzer on?
- Is the MCA8000D configured properly?

### Is the threshold correct?

- The LLD threshold should always be set above the noise of the system. If you see nothing, try setting the threshold to channel 50 and then try the acquisition again.

If you still do not see a spectrum or the correct spectrum, save a .mca file from the File menu and email it to sales@amptek.com. This file contains important information that will help Amptek troubleshoot the problem. Do not send screen shots or any other type of file. Only the .mca file is needed.

## Custom Software

The MCA8000D is NOT backwards compatible with the MCA8000A. It uses a completely different communication protocol. As a result, if you have written custom software using the MCA8000A DLL Package, it will not work with the MCA8000D. It will be necessary to re-write any custom software using the new Firmware 6 (FW6) Software Development Kit (SDK).