MCA8000A OPTION PA
INSTRUCTIONS and ADDITIONAL INFORMATION

The Option PA package has been developed to facilitate the use of the MCA8000A for particle counting in airborne (Size Calibration) and liquid suspended[1] (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 MCA8000A 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 supplied calibration curves convert the MCA channel scale to a mV scale. The calibration curves can be set to load automatically when the software opens.

Features & Specifications

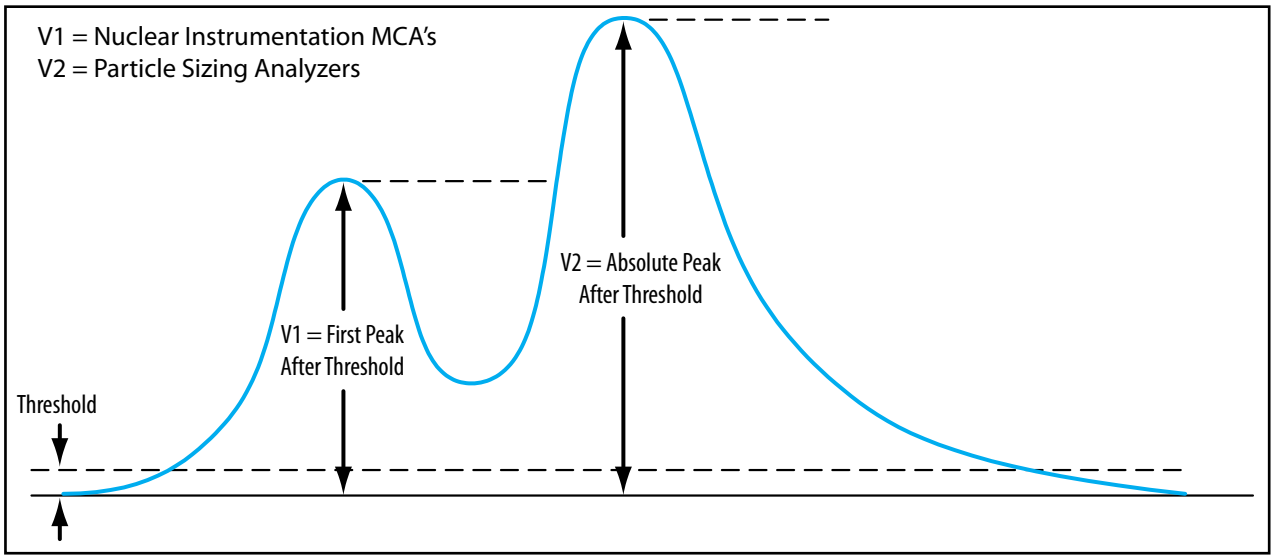
- **Pulse detection from 5 mV to 10 V**
- **3 Voltage scales: 0-0.5 V, 0-5 V, 0-10 V**
- **100 k input impedance (all three scales)**
- **NIST Traceable calibration**
- **Certificate of calibration**
- **Absolute or first peak detection mode (see figure 1)**
- **Option P or Basic units can be upgraded to Option PA**

The PA package is accurate to within 1% at 1 µs peaking time. Do not use a square wave to test the MCA8000A Option PA response. The time to peak of the input pulse must be at least 1 µs to guarantee accuracy.

The Option PA Package is NOT recommended for standard nuclear instrumentation applications.

[1]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



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MCA8000A Option PA Package NIST Traceable Certification

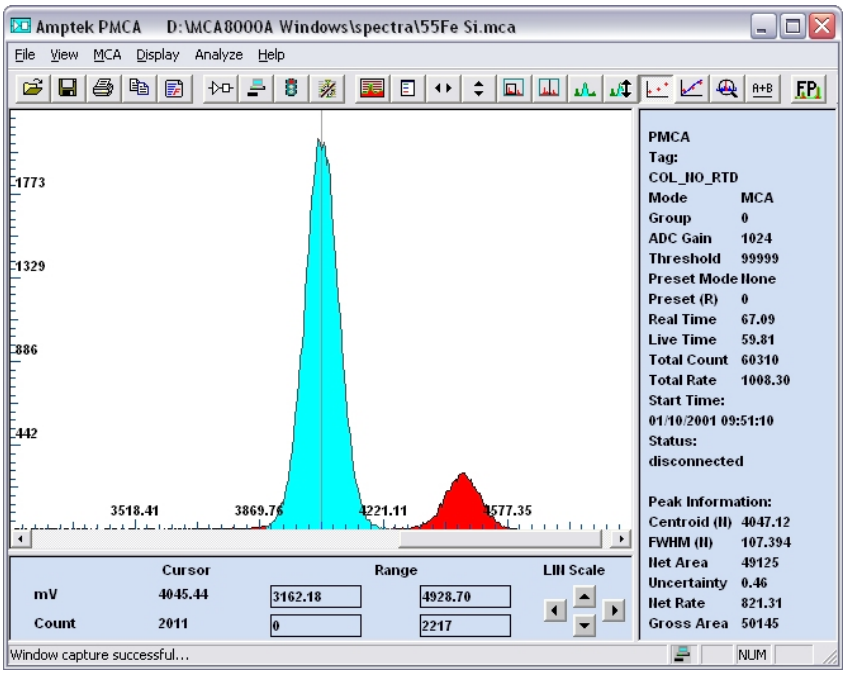
The MCA8000A Option PA package has been developed to facilitate the use of the MCA8000A for particle counting in airborne (Size Calibration) and liquid suspended (Number Calibration) particle applications. The unit is calibrated and certified traceable to the National Institute of Standards and Technology (NIST). A calibrated HP Multimeter 34401A is used to calibrate the MCA8000A 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 also required, please contact Amptek.

Standard	NIST CERT #
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 µs or greater. The MCA8000A is designed to measure only the peak amplitude of an input pulse. It is not possible for an MCA8000A 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 "MCA8000A 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 MCA8000A 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 MCA8000A 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 at right.



In the example at bove, 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 down so that the MCA reports 4000 mV.

The Option PA package was designed specifically to facilitate the use of the MCA8000A for particle calibrations. The software can be configured to automatically load the calibration file. The calibration file is needed to convert the MCA's channel scale to mV. In addition, the PA package has an extra voltage scale (0.5 V) to allow for the detection of very low amplitude pulses (down to about 5 mV). 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.

OPERATING INSTRUCTIONS

1. Windows Software

Install the Windows software by following the instructions in the MCA8000A Quick Start Guide.

1. Open the Windows software. The **Starting ADMCA** dialog will appear. Select **Open File** and load the calibration file that corresponds to the voltage scale to be used. The calibration files are in the "Admca\Spectra\Option PA Calibration Files" directory. See section 3 for voltage scale description.

   0_5v.mca for the 0-0.5 V scale
   5v.mca for the 0-5 V scale
   10v.mca for the 0-10 V Scale

2. Connect to the MCA by pressing the Connect/Disconnect button on the toolbar. Press the Acquisition Setup button on the toolbar. Set the Threshold to 7 (see section 3). If you wish to use the MCA in Absolute peak mode (see section 6) select Absolute from the Peak Mode box. All parameters in this dialog are retained by the MCA and software, so every time the software is opened, the MCA will be in the last state. Click OK. Verify that the MCA8000A is in the correct voltage range (see section 4). Note that the MCA is calibrated separately for each voltage range. If the x-axis scale does not read in mV press F7.

3. Now press the Spectra List button on the toolbar and position the dialog box on the left of your screen. The Spectra List should have two lines in it: live_data and Cal_5V (or 10V or 0_5V). There should be an A next to the Cal_5V. If there is not, click on the Cal_5V line and an A should appear. Open the Calibrate dialog from the toolbar button and position it on the right of your screen.

4. You should now be able to see both the Spectra List and the Calibrate dialogs. Click on the live_data in the Spectra List and then click OK on the Calibrate dialog. The calibration has now been applied to the spectrum. Close the Spectra List.

5. The MCA is now ready to take data. Press the Start/Stop button on the toolbar to begin data acquisition.

Refer to the Quick Start Guide or the online Help File for information on how to use the windows software.

The above procedure needs to be followed the first time the software is used and when switching calibration files (i.e. when switching voltage scales). To load the same calibration file automatically on startup (so that the steps above do not need to be repeated every time), go to the View menu and select Preferences. On the General tab in the Spectrum Template section, click the button at the right of the Spectrum Filename text box to Browse to the file. Select the appropriate file and click Open; then click the load calibration on startup option and click OK. Every time the software starts, the calibration from that cal file will be loaded.

The MCA8000A has been calibrated only in the 4k channel mode. If for some reason the setting gets changed, make sure the MCA is connected and click on the Acquisition Setup button on the toolbar. Select 4096 from the ADC Channels box and click OK.

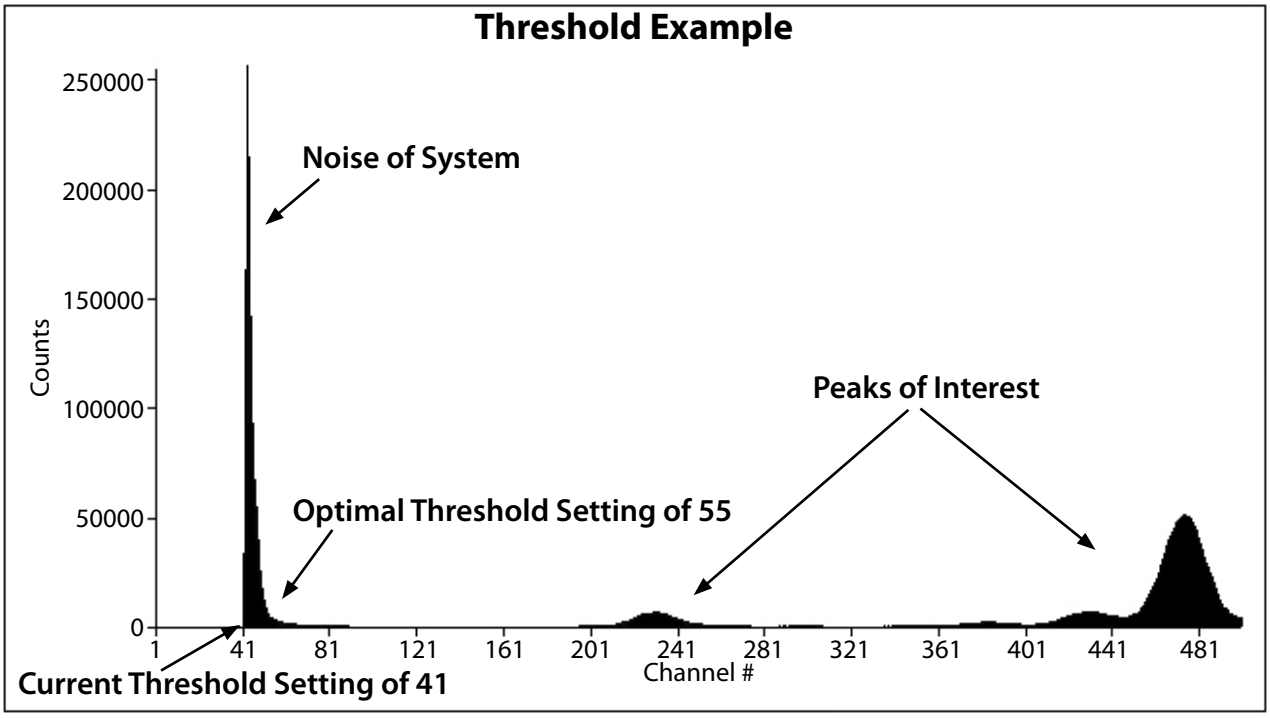
2. Setting the Threshold

The threshold is a very important parameter to set correctly. It is a low level discriminator that tells the MCA to only look at pulses above that channel. It should always be set above the noise of the system. If it is not, then the MCA will be stuck triggering on the noise and the peaks of interest will not be seen. The noise will vary depending on the gain and noise of each system.

Never set the threshold to channel 0. As a minimum, it should be set above the calibrated 3 mV level (channel 5 or greater in the 5 V scale).

To appropriately set the threshold, move the cursor to the appropriate channel above the noise wall and press F8 (F8 sets the threshold to the current cursor position). Begin an acquisition. If no spectrum appears it means the threshold is set too low and must be raised. Move the cursor up one channel and press F8. Repeat this until the spectrum appears.

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. It will take some user experience to set the threshold in an optimum way. The important thing to remember is that regardless of the pulse amplitude of the peak of interest, the threshold must be set above the noise level of the system. See the example spectrum below.



In this example, the threshold was incorrectly 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. Notice how in this example the noise extends all the way out to around channel 55. Had the threshold been set to channel 7, then no spectrum would have been seen because the MCA would have been stuck triggering on the huge number of noise counts around channel 7 instead of the peaks of interest.

3.Option PA Voltage Scale Description and Selection

Option PA provides a 3 position switch to change between the 0-0.5 V, 0-5 V, and 0-10 V voltage scales. On the back side of the MCA8000A is the following diagram:

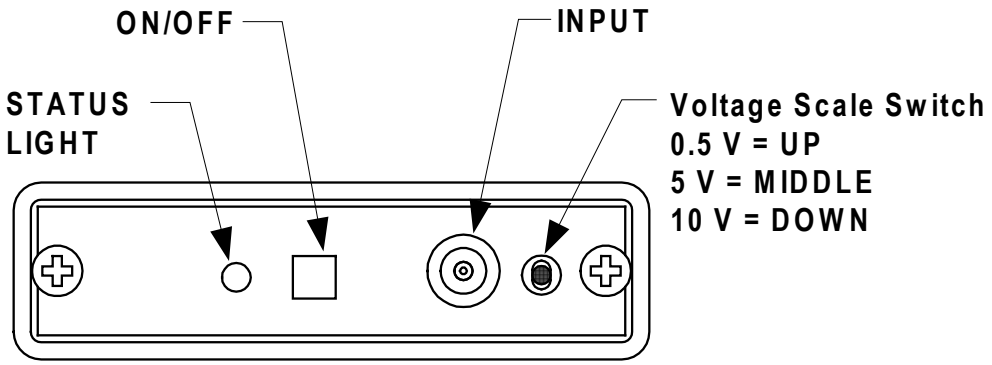
← 0.5V | 5V | 10V →

When looking at the front panel of the MCA8000A as in the figure below, the up position corresponds to the 0-0.5 V scale, the middle to the 0-5 V scale, and the down to the 0-10 V scale. Take care to make sure the MCA is in the correct range for the measurement being performed and remember to load the corresponding calibration file in the software. Follow the guidelines below for the correct voltage scale selection.

0-0.5 V scale only for very small pulses < 20 mV.

0-5 V scale for 20 mV to 5 V pulses.

0-10 V scale for 5 V to 10 V pulses.



4.MCA8000A Option PA Calibration Files

Option PA provides three calibration files: 0_5v for 0-0.5 V range, 5v for 0-5 V range, and 10v for 0-10 V range. The files will either have a .mca extension for the windows version or .asc for the DOS version. The calibration file and the voltage scale switch must always agree. All Option PA equipped MCA8000A units use the same calibration files since they were all internally calibrated to those files. The files are provided on the installation CD and can also be downloaded from the Amptek web site at www.amptek.com/mcapa.html.