X-123 QUICK START GUIDE (FW6)

For X-123 units with FastSDD®, Si-PIN, or CdTe detectors

Equipment List for an Amptek X-123 system

- X-123 X-Ray Spectrometer
- Mini USB cable
- +5 VDC power supply
- A PC with Internet access supplied by the user with Windows XP PRO SP3 or higher recommended

For help using the software please see the Help File within the DPPMCA software. The Help File contains quick start guides and "how to" instructions for many common tasks.

Software Installation

1. Install the WINUSB Driver. Please see the "WINUSB Driver Installation Instructions" for this procedure. It is highly recommended to use Windows Update to install the USB driver. https://www.amptek.com/software/dp5-digital-pulse-processor-software/dpp-installation-instructions

2. Install the DPPMCA display and acquisition software - download from our website anytime at this address https://www.amptek.com/software/dp5-digital-pulse-processor-software

3. Extract the zip file and run the DPPMCA_Setup_(version).exe file. In the installation directory is the "DPPMCA.exe" file. Open this file to start the software. You can right-click on the DPPMCA.exe file and create a shortcut which can be placed on your desktop for easy access.

X-123 Connection Instructions

1. Verify that the X-123 is completely unplugged (both USB and power).

2. Use the USB cable to connect the X-123 USB connector, which is located on the back panel, to the PC's USB connector.

3. Plug the DC power supply into a 110/220 AC outlet. Connect the other end to the X-123 power supply input, which is labeled "5V" and is located on the back panel.

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.
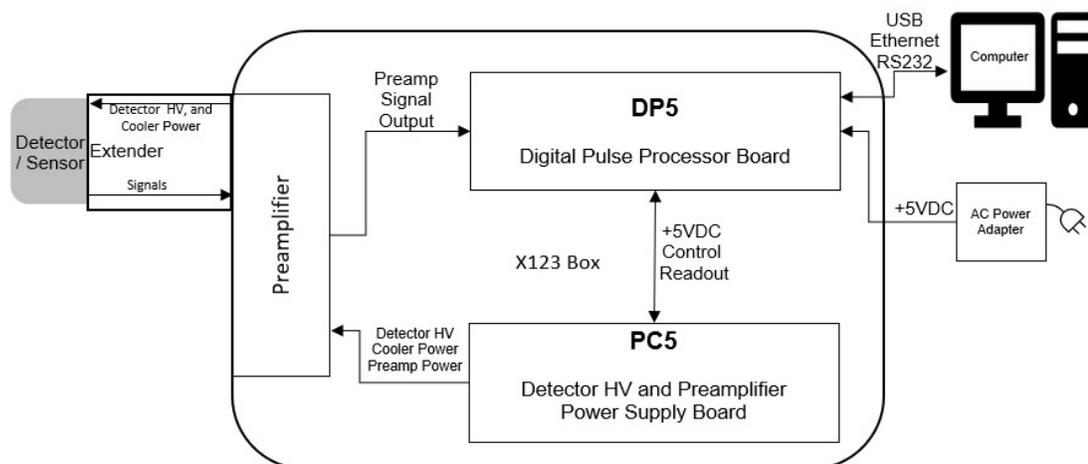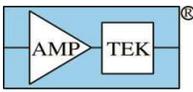
X-123 Spectrometer

Figure 1. Connection Diagram. The detector can be FastSDD®, Si-PIN, or CdTe.

Quick Use of the X-123

1. Connect the X-123 and PC as described in the previous section.

   - The X-123 stores its configuration, so when powering the system initially, the factory configuration is loaded. If you modify the configuration, the last configuration is loaded.

2. Launch the DPPMCA software by opening the DPPMCA.exe file.

3. Connect to the X-123
   a. The connection dialog will appear when DPPMCA is launched or when this icon 🖥 is pressed.
   b. Select which interface you will use (USB, Ethernet, or RS232).
   c. If more than one device is available, select the device you want using "find" and the arrows.
   d. Click "Connect" on the bottom when the desired device and connection is selected.

4. Configure the X-123
   a. The most commonly changed parameters are the gain and the thresholds.
      - To quickly change the gain, use the gain increment (decrement) buttons on the toolbar.
      - After changing the gain, remove all excitation sources, start an acquisition, then click the "Tune Slow/Fast Thresholds" button on the toolbar.

   b. For all configuration parameters, click ▷☐ , or 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 X-123.
   c. Within the DPP Setup dialog box, you can load a default configuration file for your detector or you can save and load custom configurations. For the X123 you will find the correct configurations within the DP5 folder.
   d. Configuration Tips
      - Changing the gain changes the full scale energy range. For example, a gain of 100 may correspond to a full scale energy of 15 keV, while a gain of 50 will have 30 keV full scale.
      - It is necessary to readjust thresholds (click the tune slow/fast button) whenever the gain is changed and suggested when any parameter is changed.
      - You may want to first take a spectrum and measure the energy range, to verify functionality and to determine the needed gain.

5. Acquire data
   a. Place an x-ray source in front of the detector.
   b. To start or stop acquisition, click the "start/stop" icon in the toolbar or press the space bar.
   c. To clear the data and time, click the "delete data and reset time" button in the toolbar or press "A" on the keyboard.
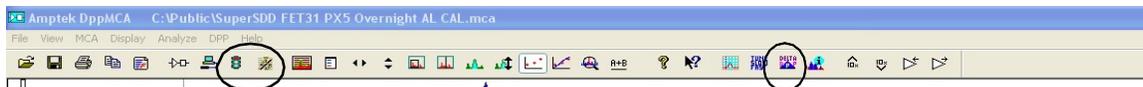

   d. Data Acquisition Tips
      - It can take minutes for an Amptek detector to stabilize after power has been applied or a configuration changed. If the spectrum looks odd, clear the data and restart.
      - You can tell that data are being acquired if (a) the spectrum appears in the window, (b) the input and total counts are increasing, (c) the accumulation time is increasing, and (d) the "status" in the right hand Info Panel reads "acquiring."
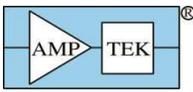
- You can set the X-123 to stop acquisition after a fixed time, after a fixed number of counts are collected, and with other options using the MCA tab on DPP setup.

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 net area and other properties are also shown.

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.
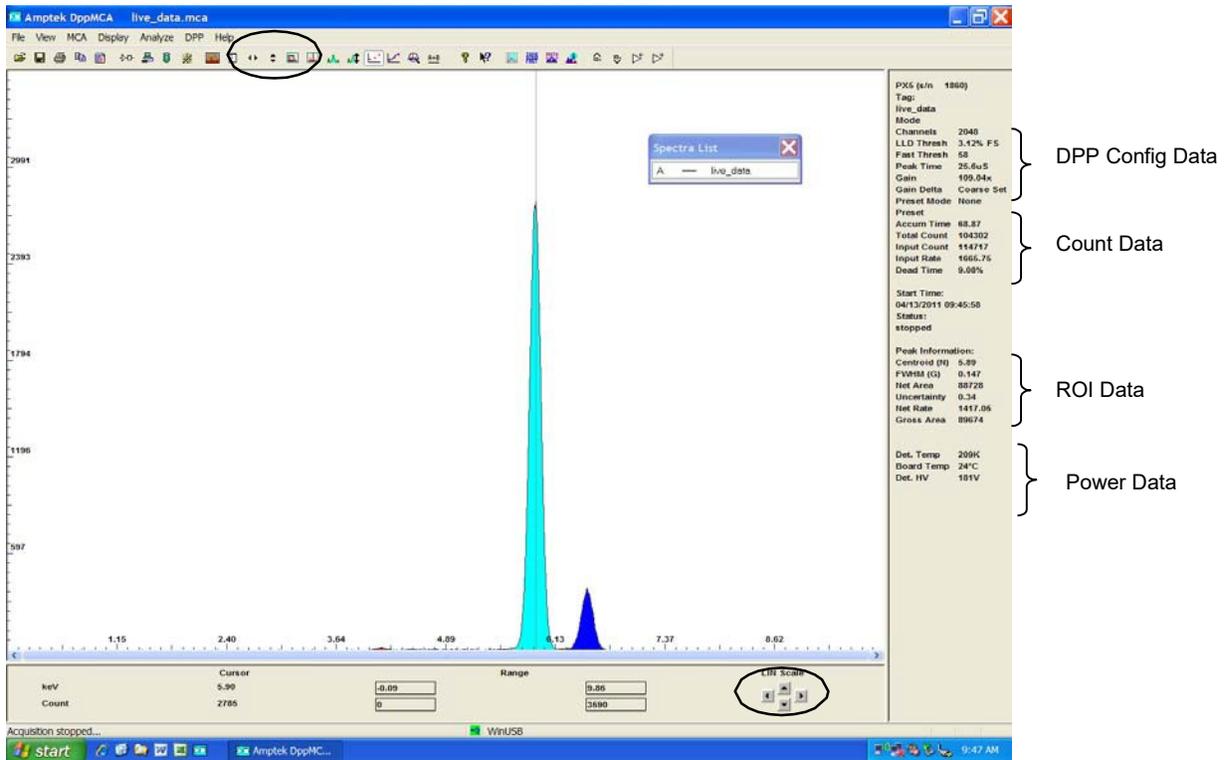
d. The primary data from the X-123 are the spectrum and the count rates. There are auxiliary outputs on the X-123. These are useful for interfacing the X-123 with other hardware. They are described in the X-123 user manuals.

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 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.

b. Energy calibration

The native scale (x-axis) of the hardware is channels. Most often you will want to convert the channel scale to energy.

1. Chose the two peaks that will be used for the calibration and make note of their energies.

2. Mark an ROI (region of interest) around each peak. This can be done by clicking the cursor at the left base of the first peak and then holding down the "U" key on the keyboard until the whole peak is
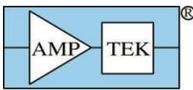
highlighted, or by using the Edit ROI button on the toolbar and then clicking and dragging across the peak until it is highlighted.

3. Now click in the toolbar button "Calibrate" (F5) to open the calibration dialog box.

4. Move the dialog box such that both peaks are visible and then click the cursor into the first peak. The peak should be highlighted and the Peak Information section on the right-hand information panel should be filled in. If the peak is highlighted and there is no peak information, then the ROI is not marked correctly. Try adjusting the start and end points of the ROI.

5. Click the Centroid button on the dialog box. This will enter the center position of the peak into the Channel box. Then enter the energy of that peak into the Value box, e.g. 6.4, and click Add.

6. Now click the cursor into the second peak (it will highlight). Click on Centroid, enter the second energy, e.g. 17.48, and click Add. There should now be two lines in the box.

7. In the Units box type in the energy units, e.g. keV.

8. Click OK. The scale should now be in energy. If it is not press F7, this toggles between calibrated units and channels.
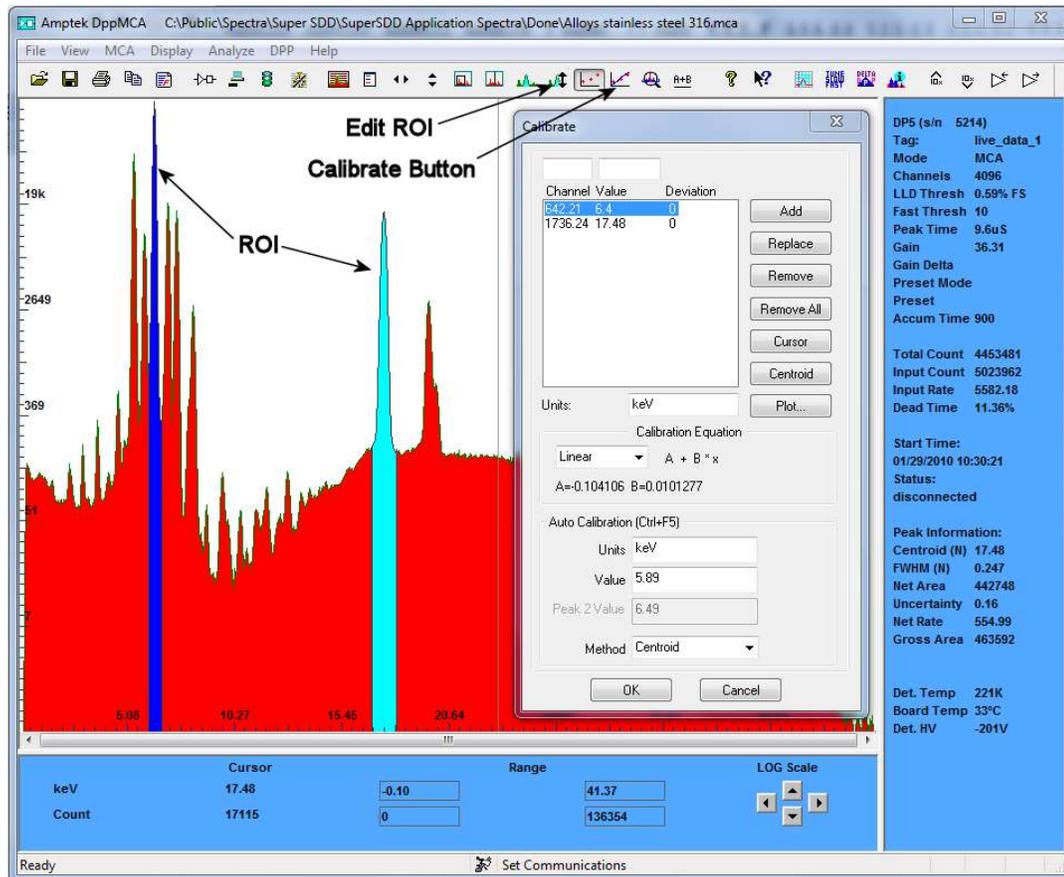
8. Save and load data

   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 process the data using a different software package the .mca file can be opened as a text file. Alternately, you can click "Ctrl-R" to copy the data to the Clipboard, then paste it where desired, e.g. in Excel.

   d. To print a spectrum press "Ctrl-P" or the "Print" icon on the toolbar.
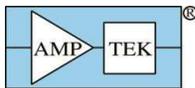
Troubleshooting the DPPMCA Software

If you cannot connect to the X-123 check the following:

- Was the software correctly installed?
- Were the drivers properly installed?
- Are all the cables connected?
- Is the X-123 power plugged in?

If you start an acquisition but see no counts:

- Is there an isotopic source in front of the detector or is the X-ray tube turned on?
- Is the DPP configured properly?
  - Amptek provides a set of default configuration files. If you are having problems, we recommend loading one of these defaults. It may not be optimum for your experiment but should get you started. Open the DPP Properties->General tab and select a configuration from the drop-down.

Does the polarity of the HV bias set in software match that set in hardware?

- Amptek FastSDD detectors require NEGATIVE HV.
- Amptek Si-PIN and CdTe detector require POSITIVE HV.
  - Check the info pane to see if the HV is enabled (if not, the reported value will be a few volts) and check the polarity. The HV is set and enabled on the Power tab of the DPP Properties.

Are the input polarity and offset correct?

- Pulses of the wrong polarity or with an incorrect input offset will be outside the range of the ADC and therefore not measured. Verify the input polarity and set the input offset to "default."
  - Amptek FastSDD® detectors require POSITIVE input polarity.
 - Amptek Si-PIN and CdTe detector require NEGATIVE input polarity.

Are pulse selection settings rejecting everything?

- The pile-up rejection and rise-time discrimination circuits will reject from the spectrum events which do not meet certain criteria (discussed in the manuals). If the system is configured incorrectly, it is quite common for no pulses to be recorded. Turn off PUR and turn off RTD while you are setting up and debugging the system. Most systems will work best with PUR enabled, once everything else is configured properly. RTD is an advanced setting and we recommend most users leave it disabled.

Are the thresholds correct?

- Always click the Tune Slow/fast thresholds button on the toolbar (with no source in front of the detector). This automatically sets the slow (LLD) and fast thresholds. It is recommended to click the tune slow/fast thresholds button whenever you change a setting.

- The Fast and Slow Thresholds can also be adjusted manually. First turn off PUR as described above. Then click the cursor to channel 1 and press F8. This will set the Slow Threshold (LLD) to channel 1. This will show the noise of the system. Click the cursor just to the right of the noise and then press F8. Press the "A" key to clear. There should be no counts accumulating. Now put the device into "Delta" mode (only one second's worth of data is displayed every second) by clicking the Delta button on the toolbar. Open the DPP properties and go to the Shaping page. Adjust the Fast Threshold until 5 to 10 counts per second appear in the Input Counts in the right-hand Info Panel. Now turn on PUR and click OK. Click the Delta button to get back to normal MCA mode and put the source back in front of the detector. The Input Counts should slightly exceed the Total Counts at low count rates. The Total Counts should always be less than the Input Counts. If they are not, then thresholds are not set correctly.

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 files 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.
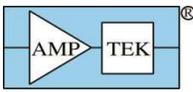
Firmware Notes

How can I tell if my DP5 or X-123 with a DP5 has FW5 or FW6?

If your unit was shipped before November 15, 2011 it has FW5. If was shipped on or after November 15, 2011 it has FW6.

If your unit connects to the ADMCA application software it has FW5. If it connects to the DPPMCA application software it has FW6.

Do I have to rewrite custom software that I developed for FW5 to support FW6?

Yes. FW6 is NOT backwards compatible with FW5. It uses an new protocol. You must implement the Software Developer's Kit (SDK). The old DPP API is NOT compatible with FW6.

FW6 SDK's are downloadable here: https://www.amptek.com/software/dp5-digital-pulse-processor-software

Which firmware version will be supported by Amptek going forward?

Only FW6 will be supported going forward. There will be no future upgrades or bug fixes to FW5. All new functionality will be incorporated only into FW6. Amptek strongly recommends that users of FW5 migrate to the FW6 platform as soon as possible. For this reason Amptek supplies a firmware uploader so that you can switch the firmware versions. See the bottom of the page at the DP5 software link above the firmware manager download.

		FW4 (legacy)*	FW5	FW6
DPP Hardware	**X-123 (with DP5)**		Optional user downgrade	Default from the factory
	DP5		Optional user downgrade	Default from the factory
	PX5			X
	Gamma-Rad5			X
	DP5G			X
	PX4	X		
	DP4	X		
	X-123 (with DP4)	X		
	Gamma-Rad	X		
Application Software	**ADMCA**	X	X	
	DPPMCA			X
Windows Update USB Driver & Operating System	**XP 32 bit**	Auto	Auto	Auto
	XP 64 bit	Manual	Manual	Auto
	Vista 32 bit	Manual	Manual	Auto
	Vista 64 bit	Manual	Manual	Auto
	Win 7 32 bit	Auto	Auto	Auto
	Win 7 64 bit	Auto	Auto	Auto

Windows 7 Compatibility Document: http://www.amptek.com/pdf/win7upgrade.pdf