AMETEK®
MATERIALS ANALYSIS DIVISION

PX5 QUICK START INSTRUCTIONS

Equipment List for an Amptek XR100/PX5 system:

- Amptek PX5 digital pulse processor and power supply.
- Amptek XR100 preamplifier and detector.
- XR100 power cable (6 pin LEMO connectors on both ends).
- Coax cable with BNC connectors.
- Mini-USB cable.
- PX5 +5 VDC power supply.
- PC (supplied by the user) with Windows XP SP2 or higher.

NOTE: This Quick Start Guide uses an Amptek XR100 detector as an example. The PX5 is compatible with many detectors. Some advanced settings may need adjustment when not using Amptek detectors. This is beyond the scope of this quick start guide. See the complete PX5 User's Manual.

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.

PX5 Connection Instructions

1. Verify that the PX5 is OFF. The light on the "ON/OFF" button on the front panel should be off.

2. Set the HV polarity jumper on the bottom of the PX5 as needed for your detector. For an Amptek FastSDD®, HV is negative. For a Si-PIN or CdTe, HV is positive.

3. Use a BNC cable to connect the "OUT" connector on the XR100 to the "AMP IN" connector on the PX5.

4. Use the 6-pin to 6-pin LEMO cable to connect the XR100 power connector to the PX5 "XR-100 POWER" connector.

5. Use the USB cable to connect the PX5's USB connector to the PC's USB connector.

6. Plug the DC power supply into a 110/220 AC outlet and connect the other end to the PX5 power supply input.

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.
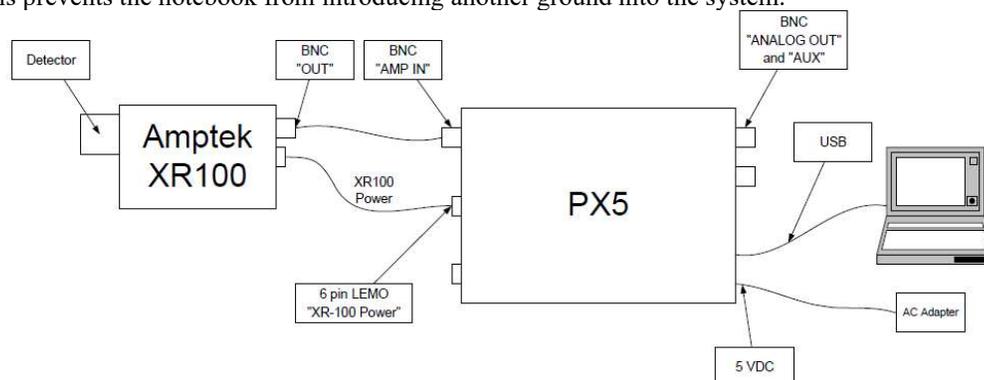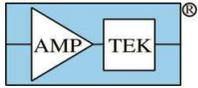

Figure 1. Connection Diagram.

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## Quick Use of the PX5 with the Amptek XR100

1. Connect the PX5, XR100, and PC as described in the previous section.

2. The PX5 stores its configuration, so when powering the system initially, the factory configuration is loaded. If you modify the configuration, the last configuration is loaded. Hold the power button labeled "ON/OFF" down until the unit beeps twice to use the configuration in memory. Pressing the power button briefly for one beep only powers on the communication and the PX5 waits for a configuration to be loaded.

3. Launch the PX5 software by opening the DPPMCA.exe file.

4. Connect to the DPP
    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".

5. Configure the PX5
    a. The most common changed parameters are the gain and the thresholds.
        i. To quickly change the gain, use the gain increment (decrement) buttons on the toolbar.
        ii. 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 [icon], 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 PX5.
    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 XR100 preamps, use a PX5 config, for all others, use a DP5 config.
    d. Configuration Tips
        i. 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.
        ii. It is necessary to readjust thresholds (click the tune slow/fast button) whenever the gain is changed and suggested when any parameter is changed.
        iii. You may want to first take a spectrum and measure the energy range, (discussed below), to verify functionality and to determine the needed gain.

6. Acquire data
    a. Place a source in front of the detector.
    b. To start or stop acquisition, toggle the "traffic light" icon in the toolbar or press the space bar.
   c. To clear the data and time, press the icon to the right of the "traffic light" or press "A".

    d. Data Acquisition Tips
        i. 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.
        ii. 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".
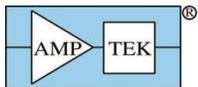
iii. You can set the DPP to stop acquisition after a fixed time, after a fixed number of counts are collected, and with other options using the MCA tab on DPP setup.

7. 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" or select the scale from the Display menu.
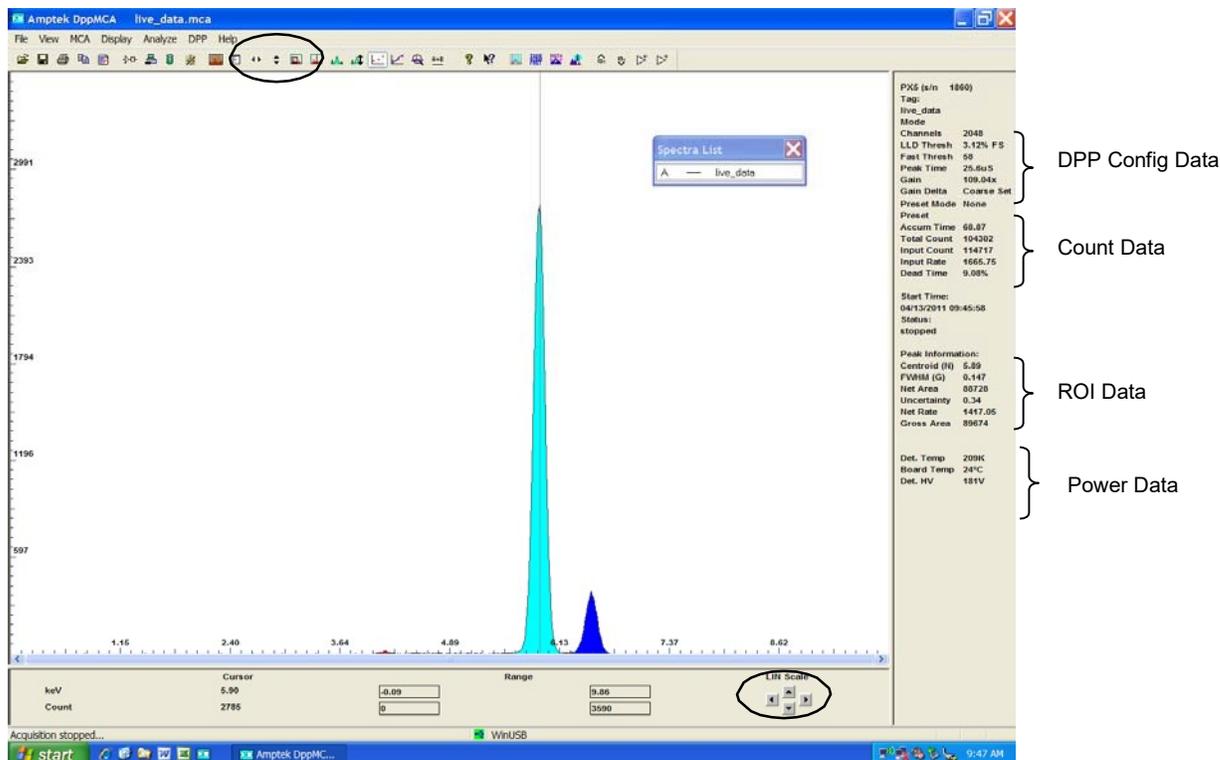

d. The primary data from the DPP are the spectrum and the count rates. There are auxiliary outputs on each Amptek DPP, logic and analog output on the various connectors. These are useful for diagnostic purposes, when setting up a system, or for interfacing the DPP with other hardware. They are described in each product's User Manual and configured in the DPP Setup.

8. Analyze data

a. DPPMCA includes basic spectrum analysis functions: defining regions of interest, calibrating the energy scale, simple mathematical expressions, and a simple peak search algorithm.

b. For more sophisticated spectrum analysis, additional software must be used. For XRF, the XRF-FP analysis software package can be purchased from Amptek.

c. Regions of Interest

i. A Region of Interest (ROI) is an area marked as a potential peak in a spectrum.

ii. 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.

iii. 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.
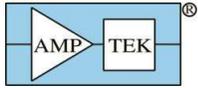
d. Energy calibration
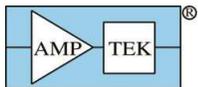
i. To calibrate the scale in the Amptek DPPMCA software follow these steps:

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.
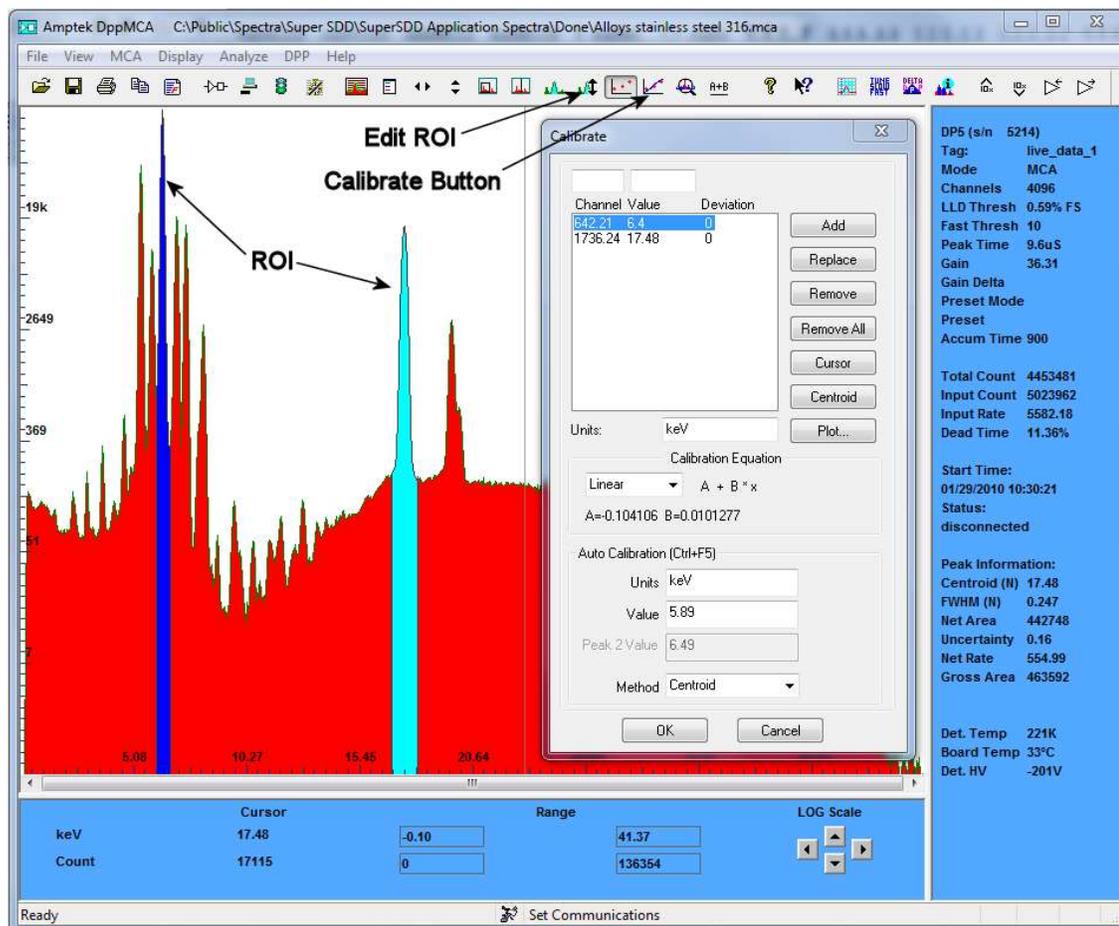

9. Save and load data

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.

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

1. If you cannot connect to the DPP check the following:

   i. Was the software correctly installed?

   ii. Were the drivers properly installed?

   iii. Are all the cables connected?

   iv. Is the DPP power turned on?

   v. Are you using compatible hardware?

   - Amptek's older DP4 generation of digital processors must use Amptek's ADMCA software with an older set of USB drivers. Please see the Windows 7 Compatibility document for more information.
   - DPPMCA interfaces with the DP5 family with a newer interface called FW6 and utilizes only the WINUSB driver.

2. If you start an acquisition but see no counts

   i. Is there an isotopic source in front of the detector or is the X-ray tube turned on?

   ii. Is the DPP configured properly?

   - A key advantage of a DPP over older analog technology is that it has tremendous flexibility so that you can optimize it for a specific application. However, it has so much flexibility that there are many ways to configure the hardware so that it stops working entirely.
   - Amptek provides a set of default configuration files for its common detectors. If you question your configuration, we recommend you load one of these defaults. It may not be optimum for your experiment but should get you started. Open the DPP Properties and select a configuration from the drop-down.

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

   - The HV power supply in the PX5 can provide positive or negative polarity (set by a jumper board on the bottom of the unit). Using the incorrect polarity could damage a detector. In the software, the user enters a polarity for the HV. The PX5 compares the polarity entered in software with the actual hardware configuration. If they do not match, then the HV power supply is disabled – and no counts will be recorded. However, if the wrong polarity is set in hardware AND in software, there is nothing that will prevent the detector from being damaged.
     - Amptek SDD detectors require NEGATIVE HV.
     - Amptek Si-PIN and CdTe detector require POSITIVE HV.
   - If you see no counts and are using an Amptek HV supply, check the info pane to see if it is enabled (if not, the reported value will be a few volts) and check the polarity.

   iv. Are the input polarity and the 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 SDD detectors require POSITIVE input polarity.
     - Amptek Si-PIN and CdTe detector require NEGATIVE input polarity.

   v. Are pulse selection settings rejecting everything?

   - The pile-up rejection and risetime 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 meet these criteria, meaning that no counts are recorded. Turn off PUR and
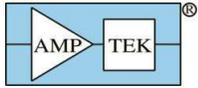
RTD while you are setting up and debugging the system. Most systems will work best with PUR enabled, once everything else is configured properly. RTD is an advanced setting that we recommend most users leave it disabled.

vi. Are the thresholds correct?

- It is always a good idea to click the Tune Slow/fast button on the toolbar (with no source in front of the detector). This automatically sets the slow (LLD) and fast thresholds.

- 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 second (i.e. 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.

3. If you still do not see a spectrum save a .mca file from the File menu and email it to sales@amptek.com.