School of Physics and Astronomy
PHYS4009 Honours Physics Laboratory

Maestro-64
Multi-Channel Analyser
Operating Instructions

Introduction

The Maestro-64 Multi-Channel Analyser is used for the following experiments: The Scintillation Counter (Analysis with Python), Absorption of γ-radiation (Analysis with Python), The Scintillation Counter and Environmental Radioactivity, Alpha Spectroscopy and Beta Spectroscopy.

Starting Up

After *login*, the software "Maestro-64" used to control the Multi-Channel Analyser (MCA) can be loaded using the Maestro program icon or using All *Programs* > *MAESTRO 64* > *MAESTRO for Windows* menu.

Data Files

The computers in the nuclear lab that are attached to MCA-related experiments are not student-networked so you will not be able to access your h: drive. Instead, you should create a folder on a memory stick and save all of the files created by Maestro there. Before the end of each lab day, you should use a student networked computer to transfer the contents of this memory stick to your h: drive for safekeeping. If you do not possess a memory stick, you can create a temporary folder on the c: drive of the computer to store your files. If this is the case, please note that you should name your directory on the c: drive with something specific to you such as your matriculation number, surname and initials, not a generic title such as "lab", "nuclear" or "spectra". When you have completed the experiment, copy all of the remaining files to your h: drive and delete any temporary folder you have created on the c: drive of the experiment computer.

The Maestro data is first stored in an integer format using files of type *.chn. These files may be converted to ASCII files of type *.spe for subsequent analysis using EXCEL or Python. Just select the *Save As* option and *Save as type*: ASCII SPE.

Menus, Buttons and Keyboard

Maestro-64 may be operated using the menus and/or buttons at the top of the screen together with the arrow keys on the keyboard. The buttons are operated using the mouse. The menus may also be operated using the mouse or may be activated by pressing the <Alt> key together with the letter underlined in the menu name. A "menu" will appear which lists the options available. To select a particular option either use the mouse or press the <Alt> key and the letter underlined in the menu option. You may also use the up and down arrows to highlight the desired option and then press <Enter>. You can use the left and right arrows to move between menus.

Full / Expand Mode

The magnifying glass buttons together with the arrow keys allow you to zoom in on regions of interest on the spectrum. The full spectrum is always displayed in the insert.

MCB / Buffer Mode, Saving and Recalling Data

Before using Maestro-64 to accumulate a data spectrum, the Detector/Buffer mode *must* be set to MCB Input. This mode is indicated in the dialogue box at the top of the screen and will end with either *Input1* or *Input2*. To switch between the two modes select the appropriate entry in the dialogue box. (Shortcut <Alt>6 or <F4>). Incoming data is stored in the MCB. You can check which input you are using by tracing the blue cables connected to the MCA.

To save your data use the *Save* option in the *Files* menu or use the *Save As* button. Your data will be saved to an integer (*.chn) file. The name can be up to eight letters long and the program will automatically add the suffix .chn. It is also a good idea to note the filename you have used for each spectrum in your lab record book. This will become very important if you save many spectra taken under slightly different conditions. If you wish to do any subsequent analysis using Python or Excel you should also save a *.spe version of your data.

If you wish to reload a saved file first select the Buffer mode. Then use the *Recall* option in the *Files* menu. The *Recall* option offers you a selection of the *.chn files held on your directory. The data read in is placed in the Buffer. This is useful for subtracting background spectra.

Note: There are two computers connected to separate Multi-Channel Analysers. The computer using *Input1* must have Maestro-64 running in order for Masestro-64 to work for *Input2* on the other computer. If you are using *Input1*, make sure that the people using *Input2* have finished recorded data before closing down Maestro-64. You can check which input you are using by tracing the blue cables connected to the MCA.

Taking a Data Spectrum

First make sure the display is set to MCB Input. The Multi-Channel Analyser unit will analyse voltage pulses which are positive and which are less than 10 Volts in magnitude. Use the oscilloscope to check that the input signal is of this form. If necessary, adjust the gain of the electronic amplifier; but not if you have already calibrated your detector. The gain must be kept constant while you make a series of measurements.

To start the analyser counting use the Go button or select the *Start* option from the *Acquire* menu. (Shortcut <Alt>l). You should begin to see the analyser display a spectrum (histogram) with Channel Number (proportional to pulse height) along the x-axis and Number of Counts on the y-axis. The display will update as the data come in and you may adjust the vertical scale using the up and down arrows.

The minimum Channel Number is 0 and the maximum is normally 511, corresponding to 10 Volts pulse height. There is a marker (cursor) in the middle of the screen, which highlights one individual channel. The cursor Channel Number and Counts are displayed at the bottom of the screen. The cursor can be moved using the left and right arrow keys,

the Page Up and Page Down keys for large jumps and the Home and End keys to move to the ends of the range. The cursor can be used to identify the position, widths and heights of peaks in your data spectra.

To stop the data acquisition, use the Stop button or select the *Stop* option from the *Acquire* menu. (Shortcut <Alt>2).

Alternatively you may pre-set a specified counting time using the *Preset Limits* option in the *Acquire* menu. You will be asked for a counting time in seconds. The data will be accumulated for the set time and then the acquisition will stop. Beware that once you have set a pre-set counting time this must be cleared before the analyser will run freely again. It is very easy to think the experiment is not working if you have a set a short pre-set counting time.

When the analyser is stopped the spectrum may be cleared using the *Clear* button or the *Clear* option in the *Acquire* menu (shortcut <Alt>3).

Subtracting Background Spectra from Source Spectra

Recall the source spectra into the buffer and then click on 'calculate' on the drop down menu at the top of the screen. Select the 'strip…' option and then choose the previously recoded background spectrum. Note this is primarily used in the Environmental Radioactivity experiment. In other experiments such as The Scintillation Counter the background is subtracted through pre-written Python program files.

Determining the peak Channel Number/ Energy (estimation)

An estimate of the channel number corresponding to the maximum number of counts for peaks in the spectrum can be estimated using the 'Region of Interest (ROI)' tool on Maestro. To fit the region of interest to a peak, click at the start of the range and drag to the end of the range. A box will appear over the range. Right click and select ROI, the peak area will become highlighted and if you click on the highlighted area the peak channel number will appear at the bottom of the screen.

Finding the number of counts under the peak

Calculating the number of peaks under the curve is similar to fitting the Region of Interest (ROI), instead of selecting 'Mark ROI' select 'Sum.' The number of counts under the peak will appear at the bottom.

Calibrating the Scale

To calibrate the scale from channel numbers to energy, click one of the peak channel numbers that the energy is calculated/ known, then select 'Calculate' from the toolbar and then select 'calibration.' Then type in the corresponding energy to the chosen channel number. Repeat 2 or 3 times on different peaks to ensure an accurate calibration. Remember to destroy the previous calibration before setting your own. Note that, because of gain drifts and other instabilities in the apparatus, an energy calibration is only reliable on the day it was first obtained.

How to Print a Screen

The <Print Screen> key on the keyboard stores the current display in the *Windows' Clipboard*. You can use the *Paste* option in *Word* or *Excel* to capture the *Clipboard* contents, which can then be printed using the Word, or Excel *Print* commands. This method gives you a hard copy of your accumulated spectra, but is rather limited in that you cannot change the scales or carry out any further analysis.

Printing using WinPlot

You can use the Maestro program WinPlot to replot data held in *.chn files. Click on the WinPlot icon or open WinPlot using the *All Programs* > *Maestro 64* > *WinPlot* menu. To load a *.chn file use the *File/Recall Spectrum* menu. The plot may be printed using the *File/Print Plot* menu.

Excel Analysis

You can use the full data analysis and graphical presentation capabilities of Excel to analyse your data. Before using Excel you have to convert the data from an integer to an appropriate format. To do this, save a spectrum using the *Save As* option in the *Files* menu and *Save as type:* ASCII SPE. The output will be written as an ASCII (*.spe) file, which can then be opened by Excel.

Python Analysis

ASCII *.spe files may be imported into Python for further detailed analysis. See separate instruction sheets.

Switching Off

Before switching off the computer close the Maestro-64 package. Close any other applications you are running and logout. It is important to logout properly.

Maestro-64 Short Cut Keys

<Ctrl><Fl>	Selects detector.
<F2>	Toggles the RIO status amongst the options Mark/Unmark/Off.
<F4>	Switches the display between the MCB and the Buffer.
<F5>	Increases the vertical scale.
<F6>	Decreases the vertical scale.
<F7>	Increases the horizontal scale.
<F8>	Decreases the horizontal scale.
<Alt>l	Starts data accumulation.
<Alt>2	Stops data accumulation.
<Alt>3	Clears the MCB.
<Alt>4	Switches the display between Full and Expand modes.
<Alt>5	Transfers data from the MCB to the Buffer.
<Alt>6	Switches the display between the MCB and the Buffer.
<Page Up>	Moves cursor large step to right.
<Page Down>	Moves cursor large step to left.
<Home>	Moves cursor to left-hand end.
<End>	Moves cursor to right-hand end.
<Left Arrow>	Moves cursor to left.
<Right Arrow>	Moves cursor to right.
<Up Arrow>	Increases the vertical scale.
<Down Arrow>	Decreases the vertical scale.