A Quick Guide to the Norland 5500 MultiChannel Analyzer

This guide provides a brief description of the basic features, functions and settings of the Norland 5500 MultiChannel Analyzer (MCA). A more complete description can be found in the Introduction and the Manual for the 5500 (see notebook in lab). The Introduction part gives an overview of the features and capabilities of the 5500. Detailed "how to" information is found in the Manual part of the documentation. This guide cites the relevant page numbers in the Introduction and Manual to find additional information on a particular topic.

The Norland 5500 MCA is an instrument capable of acquiring data in the Pulse Height Analysis (PHA) mode or the Multichannel Scaling (MCS) mode. If you are not familiar with these data acquisition techniques, see pages 73 & 74 in the Manual.

Before looking at the specifics of configuring and acquiring data with the MCA, some general comments are in order. From p. 1 of the Manual,

"A principal feature of the MCA is its membrane switch touch panel . . . . When a key is pressed, a 'beep' is heard, indicating that an entry has been recognized by the instrument."

If an entry is not valid, the MCA will beep three times and instruct you to press the CANCEL key. In general, pressing CANCEL once or twice will return the MCA to a state where all choices (RUN, SET UP, DISPLAY, etc.) are available.

"The general purpose commands used for primary instrument operation are clearly defined keys (e.g. RUN, DISPLAY, SET UP) on the MCA's front panel. Other less-used operations are activated via a group of unlabeled keys, called 'softkeys,' located just to the right of the screen. These softkeys coordinate with menus which are displayed when appropriate on the screen."

Warning: "**Never leave the display intensity turned way up for long periods of time.** Doing so will cause a permanent image to be 'burned' into the screen" (p. 6, Manual). The display intensity can be varied with the control on the rear panel. **When taking data for long periods of time the display intensity should be turned down very low.**

Acquiring Data in the PHA Mode

Note: before configuring the MCA, make sure the input pulses to the MCA are of the appropriate amplitude, i.e., between 0 and 10 volts peak amplitude. (These pulses usually come from a shaping amplifier, e.g. Ortec 485 or equivalent. You can check this out by looking at the pulses on a scope, always a good idea).

Turn on the MCA. It will go through a series of self tests and then tell you to push the CONT(inue) key. After pushing this key, the MCA will be in the same mode settings and show the same data as when it was turned off. This is because the memory of the MCA is non-volatile.

First, the Analog to Digital Converter (ADC) settings should be checked (see Manual pp. 9-12, and Introduction pp. 3-4). Press any of the three ADC keys, CONV(ersion) GAIN, OFFSET, AMP(lifier)/DIRECT, to bring up the ADC menu. Now pressing any one of the three keys will step that parameter through its range of values. To record 0 to 10 volt pulses over the entire 1024 channels of memory, CONV GAIN is set at 1024, and OFFSET at 0000. DIR(ect) is almost always the appropriate choice as signals are usually amplified to the 0-10 volt range before being sent to the MCA. When you are done checking/setting the ADC parameters, press TERM to store them in memory.

Next, check the PHA settings by pressing SET UP, PHA (see Manual pp. 31-36). To step through the parameters in the PHA menu (second line from the bottom on screen), press the CONT key. Typical settings are ADD and ALL (ALL selects all 1024 channels of memory vs. half or quarter of the channels). If you want to preset the period of time or total number of pulses to accumulate before the MCA stops acquiring data, press CONT after making the memory selection, and select the desired parameter and value. If no time or total pulse counts are preset, the MCA will accumulate data in the PHA mode until the TERM key is pressed. After the PHA parameters have been selected, press TERM to store them in memory.

The MCA is almost ready to acquire data, but first the memory must be cleared. This is accomplished by pressing the following three keys in sequence: 0, GOES INTO, ALL. Now press the RUN and PHA keys (see Manual pp. 36-37). If sensible pulses are being applied to the MCA input (have you checked them with a scope?), the MCA display should be changing as the pulses are counted and stored. If the display doesn't change, check the VERTICAL SCALE setting. 1000 counts won't show up if the setting is 1M (10^6) counts full scale!

Observe that if you increment the VERTICAL SCALE past its maximum value (10^6 counts full scale), it "wraps around" and starts again at the smallest value (in this case LOG scale). This "wrap around" behavior is common to many setting adjustments on the MCA.

When you are done collecting data, press the TERM key.

Transferring Data to the Computer

First check the I/O (Input/Output) parameters by pressing SET UP, I/O (see pp. 20-29 in the Manual). For the data transfer to be successful, the second line from the bottom of the screen must read: I/O SER 1 OUT DATA ALL (or ALL RGN). As usual, one steps through these parameters by pressing the CONT key. (The baud rate is set under the

OPTIONS menu, and it must be 19,200 with DELAY = OFF). With the I/O parameters correctly set, press TERM to store them in memory.

To transfer data to the computer, turn on the computer and login according to the TA or manager's instructions (it may already be running). Open the LabVIEW application "Norland Interface"which should be available on the desktop. When the application is loaded, start the program by clicking on the ``arrow'' button at the top left corner.

When the program starts, it will show the most recent data set that was loaded from the MCA. To transfer your data to the computer:

1 Make sure that the READY annunciator is visible at the lower left corner of the MCA screen.
2 Click the green "Read data from MCA" button.
3 Press "RUN" followed by the softkey "I/O" on the MCA.

You will see the "I/O" indicator light up on the MCA: this indicates that data is being sent over the serial line to the computer. As soon as the I/O indicator goes out (about 15 seconds), you will see your data appear on the screen.

After your data has loaded, you can save it to a file, analyze the data with the peak-fitting routine, print the data and comments on the lab printer, and load old data sets for examination and analysis. Instructions for the program are available from the ``SHOW INSTRUCTIONS'' button. You should make sure to save your data to a floppy disk or other off-computer storage device (i.e., email, memory stick, etc.); we cannot guarantee that your data will remain on the computer.

The cable from the PC connects to Serial Port 1 on the rear of the MCA.

Acquiring Data in the MCS Mode

In the MCS mode, time is on the horizontal axis and pulse count is on the vertical axis. The beginning of each sweep is initiated by a trigger pulse from the experiment (connected to the rear of the MCA). This is necessary to correlate the horizontal axis of the MCA with the time variation of some parameter in the experiment. An input pulse to the MCA will be counted any time it falls between the Lower Level Discriminator (LLD) and Upper Level Discriminator (ULD) limits (see Manual p. 13, Introduction pp. 4-5). Setting the discriminators to reject pulses not of interest for a particular measurement is essential for increasing the signal to noise ratio, e.g. in the Mossbauer experiment.

The MCS input signal is derived from the output of the Single Channel Analyzer (SCA), which is part of the MCA. The SCA output is available on the 25 pin I/O connector on the rear of the MCA (see Manual p. 64). It must be connected to the MCS input, also on the rear of the MCA. The signal from the experiment is connected to the front panel input, as usual.

To prepare for MCS data acquisition, first check the Analog to Digital Converter (ADC) settings. This procedure is described in the PHA acquisition section of this guide. Typical ADC settings are CONV GAIN = 1024, OFFSET = 0, and AMP/DIRECT set to DIR.

Next go to MCS set up by pressing SET UP, MCS (see Manual pp 39-45). Step through the MCS menu (2nd line from the bottom of the screen) by pressing CONT and making the desired choices for each parameter. The time per channel (T/CH) can be varied in decades from 10 microseconds per channel to 1 second per channel with the most significant digit being settable from 1 through 9 by pressing the desired # key. The total time per sweep is determined by the amount of memory selected and the dwell time per channel. Using all memory, the sweep time is 1024 channels * dwell time per channel. To get out of the T/CH = EXT setting, press any # key, 1 through 9. Once the MCS parameters have been set, press TERM to store them in memory.

Note: the maximum number sweeps one can enter in the menu is 9999. To do more sweeps, it is necessary to enter a short program (just a few keystrokes on the MCA -- it's easy!) to have the MCA repeat the selected number of sweeps more than one time. See Manual pp. 93-99 for programming information. One caution about programs – they are not saved when the MCA is turned off.

To start MCS acquisition press RUN, MCS. The sweep trigger signal from the experiment will, of course, need to be connected to the (rear of the) MCA. Without the trigger signal connected, the MCA will start the next sweep immediately after the previous sweep finishes. It is also useful to know that if the MCA is running in the MCS mode with nothing connected to the (rear panel) MCS input, spurious counts will be accumulated in all active channels.

To halt data acquisition in the MCS mode, flip the switch on the trigger circuit board (separate board from the MCA). This will block the trigger signal and thus prevent any additional sweeps from being triggered. Data accumulation can also be halted by just pressing the TERM key, but the last sweep will not be completed if it is still in progress.