How to read out the Multichannel Analyzers

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A Multi-Channel Analyzer (MCA) records the number of pulses received of a given pulse height (voltage). The data are stored in the form of a histogram, where each histogram bin contains a count of the number of pulses received where the pulse height is within the relatively small range associated with that bin. As used in this Laboratory the pulse height is generally taken from the output of a Time to Amplitude Converter (TAC), so that the histogram stored in the MCA is a measurement of the distribution of the length of the time intervals measured by the TAC.

It is possible to read out the data "by hand" from the MCA simply by moving the channel cursor from channel to channel using a knob on the front panel. This is fine for collecting data from a small Region of Interest (ROI), but tedious for reading out the entire MCA or a full segment of the MCA memory, either of which may cover several thousand channels. It is therefore preferable to read out the data from the MCA into a computer file. These instructions tell you how to do that using a computer using the Unix operating system.

We presently use two different models of MCA, and the instructions are slightly different for each model. The differences are:

Tracor TN-7200:
> Requires a "null modem" cable, with the serial port set to 300 baud, 8 data bits, and no parity check.

Canberra Series 35 plus:
> Requires a regular serial cable (not "null modem"), with the serial port set to 9600 baud, 7 data bits, and even parity.

The data file will be transfered to a floppy disk, so you should have a DOS formatted disk available. An unformatted floppy disk can be formatted on the computer.

The general steps required to read out the MCA are:

1. Connect the cables
2. Set the serial port parameters
3. Off-load the raw data from the MCA to the computer
4. Convert the raw data format to a histogram file
5. Copy both files to a a floppy disk

These steps are described in more detail in the rest of this document.

1. Connect the cables

The devices all use an EIA protocol called RS-232, though the older MCA manuals refer to this as simply "*the* EIA" protocol. The MCAs have 25-pin female connectors, while the computer serial port has a 9-pin male connector. You therefore need an RS-232 cable with a 25-pin male connector at one end and a 9-pin female connector at the other end.

The Tracor TN-7200 requires a "null modem" cable, which crosses the signals for TD ("transmit data") and RD ("read data"). There is a 25-pin to 25-pin null modem adapter available in the lab for use with the TN-7200. Do not use the null modem adapter with the Canberra MCA.

2. Set the Serial Port Parameters

On Linux the first serial port device is called `/dev/ttyS0` (teletype/serial port zero). You need to configure the port to the correct baud rate, number of data bits, and parity. You must first log in to the computer using an account that has the proper permissions to change th serial port settings (*i.e.*, write access to `/dev/ttyS0`).

You can inspect the serial port settings with the command

```
%  stty -a </dev/ttyS0
```

(The % represents the Unix prompt, you do not type it.) To set the serial port for the Tracor TN-7200 to 300 baud, 8 data bits and no parity, give the command:

```
%  stty 300 cs8 </dev/ttyS0
```

To set the serial port for the Canberra Series 35 plus to 9600 baud, 7 data bits, and even parity, give the command:

```
%  stty 9600 cs7 -parodd </dev/ttyS0
```

(Note that the "-" in front of "-parodd" turns off odd parity and thus implies even parity.)

3. Off-load the raw data from the MCA

It is useful to use the Unix "`tee`" command to read out the data. The "`tee`" command reads its input and writes it both to a file named on the command line and to the standard output. This allows you to see the data as it comes out of the device but also save it to the file at the same time. The command is

```
%  tee  run047.d  </dev/ttyS0
```

This saves the raw data to the file `run047.d`. You should use a unique and distinguishable name for each separate readout.

When this command is given the computer will wait for the data from the MCA. Press the appropriate button sequence to send the data to the serial port:

Tracor TN-7200:
> Press "Stop" to turn off data acquisition, and then press 'Out".

Canberra Series 35 plus:
> Press "Collect" to turn off data acquisition, and then press "Read Out"
> and verify the offered parameters at the bottom of the screen. Press

"Yes" to start data output. (Press "No" if you need to change parameters and it will step you through the parameters.)

When the readout is done, press "Control-C" on the computer keyboard (hold down the "ctrl" key and press the "C" key) to terminate the `tee` program. The data ouput from the MCA will be saved in the file named on the command line of the `tee` command (eg. `file047.d`).

4.   Convert raw data format to histogram file

Mr. Myers will write a Data Acquisition (DAQ) program to do this, but until he does so he will have to help you with this "by hand". The end result will be another file called `file047.h` (for this example).

5.   Copy files to a floppy disk

To copy the files to a floppy disk you first insert the disk into the drive and then give the command to mount the disk:

```
%  mount /floppy
```

You must use a computer account that is authorized to control the floppy drive, and the mount point must be properly defined in the file `/etc/fstab`.

If you find that your floppy disk is not already formatted then you can format it with the command:

```
%  /sbin/mkdosfs  /dev/fd0
```

This will erase all the data already on the disk. Then mount the disk as `/floppy` as shown above.

Once the disk is mounted you can copy files to it with the Unix copy command:

```
%  cp  run047.d  run047.h
```

It is better to copy the files rather than moving them so that you still have a backup copy on the computer.

Finally, you must unmount the floppy disk before you remove it from the drive. The command is:

```
%  umount /floppy
```

Then pop the disk out. Please do not pop the disk out without giving this command, as it confuses the computer.