multi-channel scaler/counter timer module
MCS-CT3

user manual

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### MCS-CT3 multi-channel scaler/counter timer module

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1 Introduction

The MCS-CT3 is primarily designed, when incorporated into a photon counting system, to be a photon counting multichannel scaler counter timer. A typical photon counting system is shown in section 3.

2 installing the software

Software, user manual, and programming guides may be downloaded from the MCS-CT3 page on the ET Enterprises website (www.et-enterprises.com) by selecting PMT accessories and then MCS-CT3 Multi-Channel Scaler.

Double click on the MCS-CT3 setup programme MCS-CT3 Setup.exe; the setup wizard will guide you through the setup process.

The software is installed in C:\ETEL\Counter Timer. Shortcuts to the various applications are installed on your desktop and in the MCS-CT3 program group in your start menu.

To uninstall the software run the uninstall program from the MCS-CT3 program group in the start menu. All of the installed files will be removed from your system. The output folder (C:\ETEL\Counter Timer\Output) and its contents will not be removed; you may delete this folder and the files manually if you wish.

3 basic system

The schematic diagram below shows a typical photon counting system incorporating a photomultiplier and electronic modules that are available from ET Enterprises.
1 Channel Counts

The text box shows the current channel counts.

Click the Start button to start a sequence of counts.
Click the Stop button to stop a sequence of counts.

When the sequence of counts is stopped, a time stamped text file containing the counts is stored in the output folder (C:\ETEL\Counter Timer\Output)

2 Channel Width

Enter the Channel Width in the text box and use the radio buttons to select the Channel Width Units.

Press the Enter button to confirm the selection.

For milliseconds, the Channel Width can be set from 0.2 ms to 999.0 ms in steps of 0.2 ms.
For Hours, Minutes and Seconds the Channel Width can be set from 1 to 999 in steps of 1.
3 Number of Channels

Enter the Number of Channels in the text box. Press the Enter button to confirm the setting.

For continuous running (until the Stop button is pressed) set the Number of Channels to 0.

The Number of Channels may overrun when a small Channel Width is selected. Channel number shows the current channel number.

4 Graph

Uncheck the Overwrite Graph check box to plot up to six graphs.

Check the Suspend Plotting check box to stop the graph plotting.

Depending on the speed of your computer and graphics card, plotting a graph of several thousand points may cause channels to be missed. So when using small channel widths for long runs is best to suspend graph plotting.

5 Trigger and Outputs

Use the radio buttons to enable or disable the trigger, and set the outputs high or low. Press the Enter button to confirm the settings.

To use the trigger input, Enable the trigger and then start a sequence of counts by clicking the start button. When the trigger input goes low a new sequence of counts starts, the sequence is stopped when the trigger goes high and a time stamped output file is created.

Either disable the trigger or click the Stop button to ignore the trigger input.

The outputs may be changed at any time even in the middle of a sequence of counts. The outputs actually change when the Enter button is pressed.

6 Device

Two MCS-CT3 modules can be operated simultaneously. Use the radio button to select which device to view.

The Start and Stop buttons control both MCS-CT3’s. If one of the devices is stopped either by the Stop button, its trigger input or because it has reached its channel counts both devices will stop.

All of the other settings are independent.
4.1 the file menu

1 Graph tools

Allows you to see a print preview of the graph, print the graph or save a screen shot of the graph.

2 Open Output File

Opens the output file folder

3 Find USB Devices

If you start the windows application before connecting the MCS-CT3 to the computers USB port, use Find USB Devices to allow the application to find the MCS-CT3.
4.2 the output files

The output file is a simple text file with each channel count on a new line.

The output file filename contains a time stamp giving the day, month, date, time (hh_mm_ss) and year.

There are two output files: Output_1 for device one and, Output_2 for device two. They are saved in C:\ETEL\Counter Timer\Output.

It can take a long time to open the file and copy and paste the counts if the file is very large.
You have to enable macros to use the MCS-CT3 Excel Control.xlsm spreadsheet.

1 The windows Excel application

This application starts automatically when you open the MCS-CT3 Excel Control.xlsm spreadsheet. It acts as the interface between Excel and the MCS-CT3 USB device.

Two MCS-CT3 modules can be controlled simultaneously.

The application shows the counts for each MCS-CT3 connected.

2 High Voltage

Set the required High Voltage. The High Voltage setting is actually activated when a sequence of counts is started.

The High Voltage output from the MCS-CT3 is a 0 to 2 V output designed to connect to the ‘White Wire’ control input for the ET Enterprises range of HV Bases. It can also be used for other supplies that accept a 1:1000 control voltage input.
3 Channel Width

Enter the Channel Width and the channel width units. The Channel Width setting is actually activated when a sequence of counts is started.

For milliseconds, the Channel Width range is from 0.2 ms to 999.0 ms in steps of 0.2 ms. For Hours, Minutes and Seconds the Channel Width range is from 1 to 999 in steps of 1.

Excel does not correct or limit the user input. Values outside the acceptable range will be set to the nearest acceptable value, however this value will not be shown in the spreadsheet.

4 Trigger Enable

The trigger is either enabled or disabled when a sequence if counts is started.

To use the trigger input, Enable the trigger and then start a sequence of counts by clicking the start button.

When the trigger input goes low a new sequence of counts starts, the sequence is stopped when the trigger goes high.

When the Stop button is pressed the counts from all the triggered events are copied into the Data sheet of the Excel workbook.
5 Outputs

Sets the outputs high or low. The outputs setting is actually activated when a sequence of counts is started.

6 Start and Stop buttons

The Start and Stop buttons start and stop a sequence of counts.

When a sequence of counts is stopped, the counts appear in the next column of the Data sheet of the Excel workbook. A time stamp of when the sequence of counts was written appears in the first row of the column.

Row three contains the channel one count, row 4 the count for channel two etc.

7 Timed Run

Enter the time in seconds that you want the sequence of counts to run for and click the Timed Run button.

After the set time has elapsed the sequence of counts will stop and the counts will appear in the next column of the Data sheet of the Excel workbook. A time stamp of when the sequence of counts was written appears in the first row of the column.

The timed run cannot be stopped by clicking the stop button. To end a timed run early press the Esc key and click End in the Microsoft Visual Basic dialog box and then click the Stop button.
8 Programmed Run

The Programmed Run allows the automatic plotting of plateau plots if your system allows the High Voltage to be set using a 1:1000 control voltage.

**HV Start:** The starting High Voltage  
**HV Stop:** The end High Voltage  
**HV Step:** The voltage increment between counts.

**Maximum counts:** The programmed run will end early if the counts go above this value. Set this value to a safe level to help protect the PMT.

**Measure Time:** Set the measure time to one channel width longer than the channel width setting so that you get one count per HV setting.

**Delay Time:** The time delay imposed after the HV has been set to its new value used to allow the HV to settle before starting the count. A channel width of 1 second, a measure time of 2 seconds and a delay time of 3 seconds are good settings to start with.

The High Voltage and the counts for a programmed run are written to the Chart sheet of the Excel workbook. The data are plotted automatically on the Plateau Plot graph.

9 Delete

Deletes the data in the Data and Chart Data sheets and resets the indices so that new data will be put into the Data sheet or Chart starting the beginning of the sheet. Copy any data you wish to keep to another sheet before clicking the Delete button.

The indices are reset every time the MCS-CT3 Excel Control.xlsm spreadsheet is opened.
5.1 the settings files

The settings file is a normal readable text file used in conjunction with the windows Excel application to control the MCS-CT3.

The MCS-CT3 Excel Control.xlsm spreadsheet controls the MCS-CT3 by writing to the settings file. The MCS-CT3 responds when the settings file is saved. You can also control the MCS-CT3 by modifying the settings file using notepad.

The settings file is also used to remember the MCS-CT3 settings when the application is closed or the computer is switched off.

There are two settings files: Settings_1.txt for device one and, Settings_2.txt for device two. They are saved in C:\ETEL\Counter Timer.

In the settings file `';' means comment and everything from the `';' to the end of the line is ignored. If using Visual Basic for Applications (VBA) do not use a comma in comments.

The first non comment item must be the Command.  
The second non comment item must be the High Voltage.  
The third non comment item must be the Discriminator.  
The forth non comment item must be the number of channels.  
The fifth non comment item must be the Channel Width.  
The sixth non comment item must be the Channel Width Units.  
The seventh non comment item must be the Trigger.  
The eight non comment item must be Output 1.  
The ninth non comment item must be Output 2.
5.2 the output files

Unlike the windows application, the output files generated using the windows Excel application are not time stamped. This makes it easier for Excel to find the output files. When Excel reads the output files, it deletes their contents so there is no chance of data being read twice.

When a sequence of counts is stopped, Excel reads the output files and writes the data in the next column of the Data sheet of the Excel workbook. Excel generates a time stamp of when the sequence of counts was written which appears in the first row of the column.

There are two output files: Output_1.txt for device one, and Output_2.txt for device two. They are saved in C:\ETEL\Counter Timer\Output.

6 the labVIEW virtual instrument

1 Channel Count

Shows the current channel count.

2 High Voltage

Set the required High Voltage.

The High Voltage output from the MCS-CT3 is a 0 to 2 V output designed to connect to the 'White Wire' control input for the ET Enterprises range of HV Bases. It can also be used for other supplies that accept a 1:1000 control voltage.
3 Channel Width

Enter the Channel Width and select the Channel Width Units. The indicator shows the actual Channel Width set.

For milliseconds, the Channel Width can be set from 0.2 ms to 999.0 ms in steps of 0.2 ms.

For Hours, Minutes and Seconds, the Channel Width can be set from 1 to 999 in steps of 1.

4 Number of Channels

Enter the Number of Channels. The indicator shows the current channel number.

For continuous running (until the Stop button is pressed) set the Number of Channels to 0.

When the sequence of counts is stopped, a time stamped text file containing the counts is stored in the output folder (C:\ETEL\Counter Timer\Output).

The Number of Channels may overrun when a small Channel Width is selected.

5 Trigger

Enable or disable the trigger.

To use the trigger input, Enable the trigger and then start a sequence of counts by clicking the Start button. When the trigger input goes low a new sequence of counts starts, the sequence is stopped when the trigger goes high and a time stamped output file is created.

Either disable the trigger or click the Stop button to ignore the trigger input.

6 Outputs

Set the outputs high or low.

The outputs setting is actually activated when the Start button is clicked. The outputs setting cannot be changed in the middle of a sequence of counts.

7 Start and STOP buttons

Click the Start button to start a sequence of counts and the STOP button to stop the sequence of counts.

When a sequence of counts is stopped, a time stamped text file containing the counts is stored in the output folder (C:\ETEL\Counter Timer\Output).
6 the labVIEW virtual instrument (cont’d)

8 Exit button

Closes the USB device and exits the virtual instrument.

9 Graph

The graph shows a representation of the channel counts. The graph may, depending on the Channel Width selected, display too many points.

Use the data stored in the output file for any subsequent analysis.

6.1 the output file

The output file is a simple text file with each channel count on a new line.

The output file filename contains a time stamp giving the day, month, date, time (hh_mm_ss) and year.

It can take a long time to open the file and copy and paste the counts if the file is very large.

6.2 the dynamic link library (DDL) file

The LabVIEW VI works in conjunction with a dynamic link library called ETELCounterTimer.dll which is installed in the C:\ETEL\Counter Timer folder. The ETELCounterTimer.dll handles the USB interface and writes the time-stamped output file.

If you move the ETELCounterTimer.dll from its default location, double click the Call Library Function node in the block diagram and modify the Library name or path dialogue.

7 the software source code

Windows applications

The source code for the windows application, the windows Excel application and the dynamic link library used with the LabVIEW VI is installed in the C:\ETEL\Counter Timer\Source Code folder.

The code was built using Code::Blocks IDE, wxWidgets GUI builder (installed from wxPack) and minGW gcc toolchain.

See: http://wxpack.sourceforge.net/Tutorials/CodeBlocks for a tutorial describing how to setup a windows machine with everything you need to develop wxWidgets applications with Code::Blocks using MinGW Gcc as the compiler.

Excel macros

You may view, edit or add to the Excel macros by using the Visual Basic editor provided with Excel.

LabVIEW virtual instrument

The MCS-CT3 LabVIEW virtual instrument was developed using LabVIEW Base Development System.

You may view, edit or add to the block diagram using LabVIEW development software.