

# multi-channel scaler/counter timer module

## MCS-CT3 data sheet (provisional)

### 1 description

The MCS-CT3 is a cost-effective, high performance pulse counting instrument for use with a PC or Laptop via the USB 2.0 interface. It can be operated as a laboratory rate-meter or, when used with an ET Enterprises AD8 amplifier/discriminator and suitable detector, it becomes a wide dynamic range photon counting system.

The MCS-CT3 is a compact electronics module which records and stores pulses as a function of time. There is a choice of three software configurable counting modes: pre-set number of channels, pre-set total measurement period, or continuous measurements. Operation and data retrieval can be controlled from the supplied application software or from the users' own customised code. Measurements can also be controlled by an external trigger input, and there are two trigger outputs for control of associated hardware such as optical shutters. At the end of a measurement cycle the results are automatically saved to an MS Excel compatible file for subsequent analysis and/or export to other programs.

The unit incorporates a software controlled analogue voltage output which can be used to program the high voltage supply to a photomultiplier, for example with the ET Enterprises series of photomultiplier HV Bases. This feature allows automatic plateau plots to be generated to determine the optimum operating voltage for photon counting operation. A maximum count rate can also be set to protect against overload of the photomultiplier.

Two software applications are supplied with the MCS-CT3, both of which are quick to install and easy to use. 'MCS-CT3 Control' is a dedicated stand-alone application which includes all of the features of the previous ET Enterprises CT2 Counter Timer software. 'MCS-CT3 Excel Control' is an MS Excel based application that controls the MCS-CT3 directly from macros. Both applications can be customised without the need for ActiveX™ controls.

A LabVIEW virtual instrument program option is included.

Power for the MCS-CT3 is supplied via the PC USB 2.0 connection so no additional power supply is needed. A low voltage output socket can be used to power an ET Enterprises AD8 amplifier/discriminator.

### 2 applications

The MCS-CT3 is suitable for all applications involving the counting, storage and subsequent processing of TTL pulses as a function of time. It is particularly applicable to time-resolved single photon counting mode operation when used in combination with TTL output AD8 amplifier/discriminator.



### 3 features

- count rates up to 150 MHz
- trigger input for synchronous counting
- accepts TTL input
- two modules can be operated simultaneously
- easily configured as a laboratory rate-meter
- channel widths from 200µs to 999hr
- number of channels from 1 to 65535, or continuous operation
- software can be customised by user
- compact

### 4 operating modes

The following operating modes are available with the software provided:

- fixed number of readings
- continuous readings
- fixed run-time
- automatic plateau plots (when using pmt HV control output)
- external trigger option to start and stop measurements

### 5 additional equipment required

Any PC or laptop with a free USB port and windows from XP to Win 7 and minimum specification of: 32 or 64 bit, 2GHz, 2GB of RAM

## 6 software

The MCS-CT3 is supplied with two separate software applications both of which have sufficient functionality to enable operation as a counter timer, or a photon counting system when combined with an ET Enterprises TTL output AD8 amplifier/discriminator and detector.

The open-source 'MCS-CT3 Control' application is a stand-alone program with the following features:

- selection of channel width and number of channels
- enabling/disabling of trigger-in and of trigger-out I/O channels
- setting of pmt HV via a 0 to +2V control voltage output line
- selection of chosen MCS-CT3, where two are used
- manual start and stop of measurement run
- automatic charting of channel counts vs channel number
- option to disable chart-overwrite to allow up to six previous plots to be retained
- numerical display of each count reading
- automatic saving of data in text files for subsequent analysis/export
- supplied with source code for user-customisation

The 'MCS-CT3 Excel Control' application is an MS Excel macro based interface which is intended to be more readily customised than the 'MCS-CT3 Control' software. As supplied, it provides the following features:

- selection of channel width and total run-time
- enabling/disabling of trigger-in and of trigger-out I/O channels
- setting of pmt HV via a 0 to +2V control voltage output line
- selection of chosen MCS-CT3, where two are used
- manual start and stop of measurement run
- automatic plot of pmt plateaux curves for optimisation of operating voltage
- automatic saving of count data in a separate Excel worksheet
- optimum flexibility using readily adaptable open-source MS Excel macros

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

An example of a continuous dark count run, with plotting activated, using the MCS-CT3 control software is shown in figure 1. This was obtained using a photomultiplier type 9107B and an AD8 operating at room temperature.

A photon counting signal plateau curve, for the 9107B photomultiplier, is shown in figure 2.

## 7 hardware

<b>power consumption</b>	
voltage	+5V (from USB connection)
current	15 mA max (MCS-CT3 only)
<b>signal input</b>	
connector	BNC socket
levels	3.3V TTL logic
impedance	50 Ω
pulse width	1.7ns (minimum)
pulse pair resolution	1.7ns (minimum)
count rate	up to 150MHz
channel width	0.2ms to 999hr
channel width jitter	200µs
dead time between channels	none
number of channels	1 to 65535 or continuous
counts per channel	100000000 max
<b>USB interface</b>	
type	USB 2.0 or higher
connector	micro USB type AB
<b>I/O channels</b>	
trigger-in	TTL pulled up to 3.3V, trigger active low
time jitter	200µs
connector	BNC socket
digital-out 1	common source 100k pull-up to 3.3V
current source or sink	20mA
digital-out 2	common source 100k pull-up to 3.3V
current source or sink	20mA
connector	terminal block
<b>fixed voltage out</b>	
voltage	+5V
current	max 50mA (subject to USB limit)
connector	2.1/2.5mm power socket
<b>control voltage out</b>	
voltage	0 to +2V
maximum load current	20mA
<b>general</b>	
weight	140 grams
dimensions	87 x 64 x 26mm

## 8 ordering information

<b>MCS-CT3</b>	boxed electronic module including matching USB cable
<b>LEADBNC - 50cm</b>	50 cm long 50Ω signal cable
<b>LEADBNC - 100cm</b>	100 cm long 50Ω signal cable

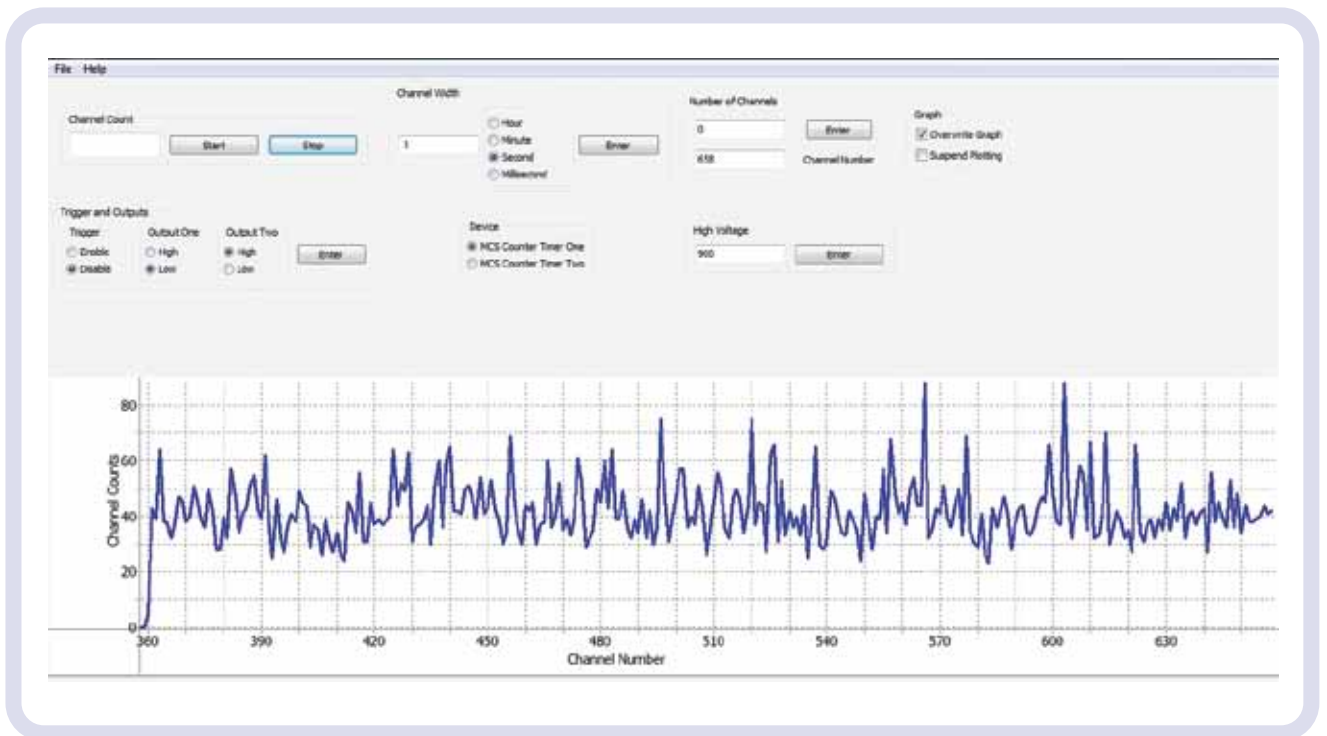


figure 1 dark count run for photomultiplier type 9107B

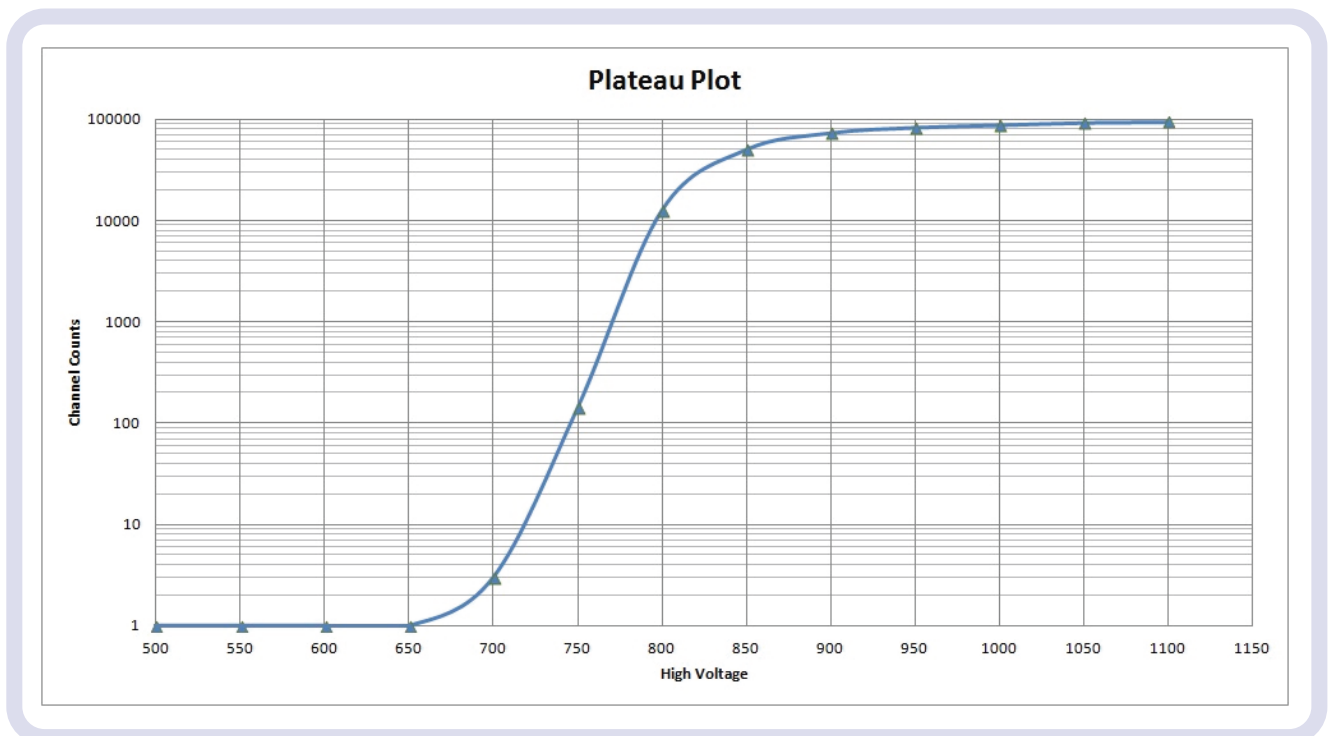
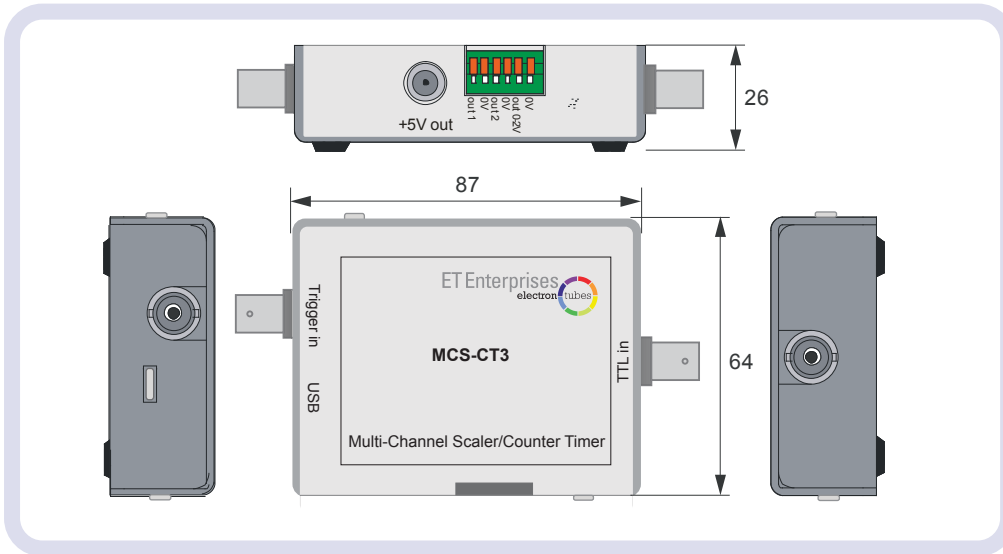
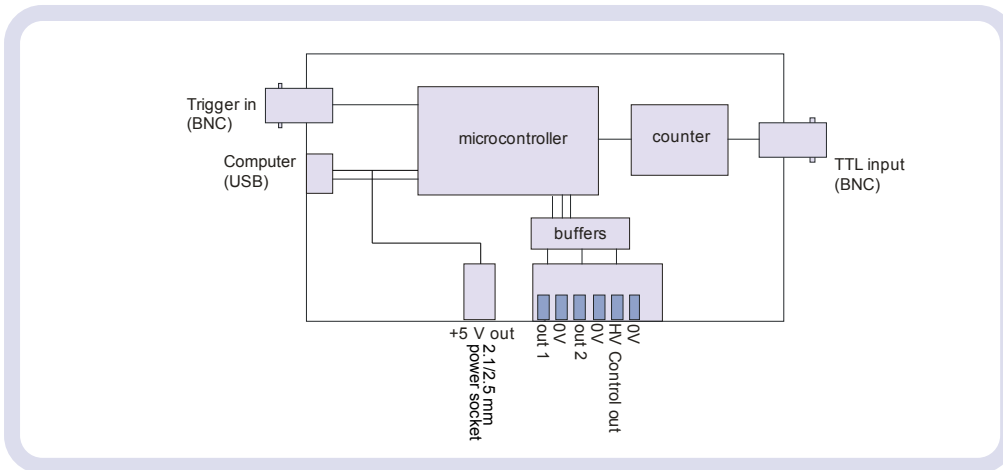


figure 2 signal plateau plot for photomultiplier type 9107B

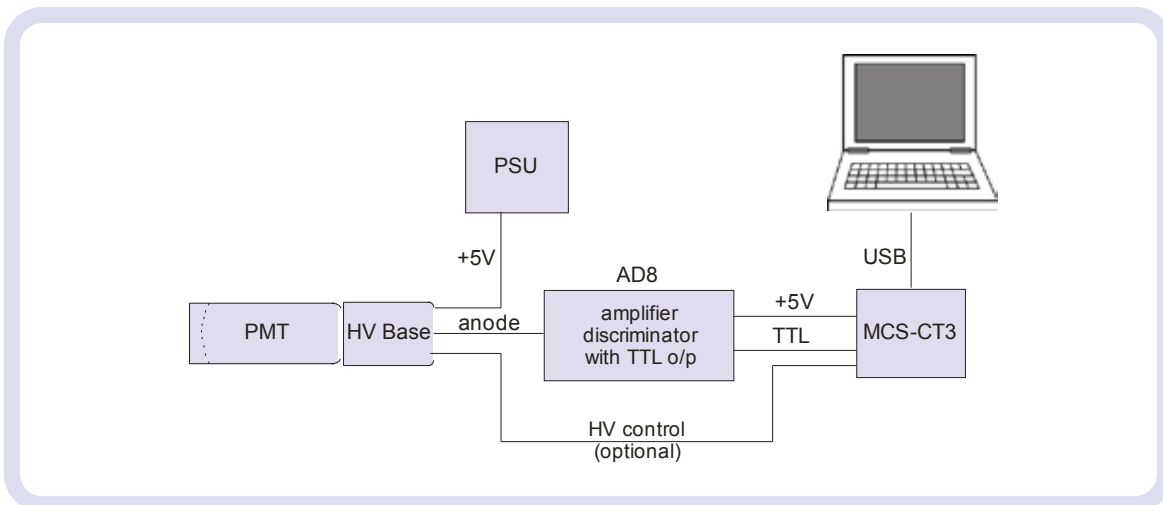
9 external dimensions (mm)



10 functional diagram



11 typical photon counting system



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