Manual for Electronic counter

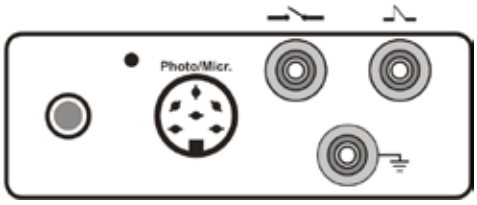
27.09.13 2002.50 AE

Stopwatch

- Simple start/stop-function
- Velocities before and after collisions
- Acceleration
- Period
- Frequency counter

Counter

- Counting with manual timing
- Counting for 1, 10, 60 or 100 seconds
- Single or repeated count



INPUTS

In both groups A and B, there are four types of inputs. Only one of these are used in each group.

Jack socket

Typically, this input is used with our GM sensors 5135.70 and 5135.65, our Geiger counter 5136.00, coincidence-box 5138.00 as well as various equipment with Jack plug from Pasco.

DIN connector

This input is used to photocells (1975.50 and 1975.15) and microphones (2485.10) from Frederiksen. (Older models of sensors and microphones can usually also be connected via an adapter.)

QUICK-GUIDE

As a general rule: An LED *turned on* indicates an active function. A flashing LED indicates a possible choice.

Connect a signal source to one of the inputs in group A (and eventually one in B). The inputs in each group are equal.

Select the function by rapidly pressing the Select button until the desired mode is selected. The function is selected when you pause (about 1 second).

Counting interval for the *Count* function: When *Count* is selected, continued pressing of the *Select* button selects the counting period.

Repeated measurements for *Period, Frequency*, or *Count:* When the *Continuous* LED is flashing, press the *Memory/Continuous* button. The LED lights up steadily.

Memory: For instance *Collision* will provide up to four results. The LED next to the button *Memory/Continuous* will flash to indicate that memory contains data. Press the button to switch between them.

Resetting after a measurement is made by pressing *Select* once.

Be sure to position the DIN connector correctly in the socket! It is possible to brutally force the plug in, even if it is upside down – which will usually destroy the connected equipment.

Switch input

This entry consists of the left of the two red safety sockets (signal) and the black (ground). A typical application is our free fall apparatus, but all types of switches can be used.

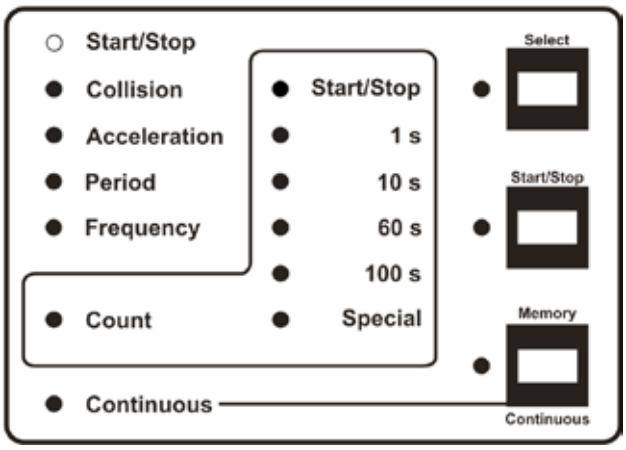
Pulse input

This input consists of the right of the two red safety sockets (signal) and the black (ground). All kinds of (positive) electrical pulses can be used with this entry. (For example, older types of Geiger counters provide a pulse output with plugs that match this input.)

A/S Søren Frederiksen, Ølgod
Viaduktvej 35 · DK-6870 Ølgod
Tel. +45 7524 4966
Fax +45 7524 6282
info@frederiksen.eu
www.frederiksen.eu

In contrast to the other inputs, the pulse inputs are not identical; in group A, the pulse input is more sensitive than in group B.

(Inputs are further described in *Technical Specifications.*)



OPERATION

Start/Stop

Press the Select button repeatedly until the *Start/Stop* LED is lit. The setup is now ready.

The device works like a regular or an electronic stopwatch. The time can be started and stopped manually (with the *Start*/*Stop* button) or with signals fed to inputs A and B.

The result is reset by pressing the *Select* key.

Measurements are stored in the internal memory - see later.

Collision

This function is used with two photocells and two cars or carts equipped with a ”tab” that can interrupt the light to the photocell. The device times up to four such interruptions; this will occur in an elastic collision on an air track, with the carts first moving towards each other and then away again.
The four speeds are determined from the tab length, divided by the time of passage.

Press the *Select* button repeatedly until the *Collision* LED is lit. Wait a moment and press *Start*/*Stop*.
The setup is now ready.

The first measurement will remain in the display until all data is recorded. When the photocells have been interrupted four times, the first time of passage from input A is shown. The other times are called up by pressing *Memory*/*Continuous*. Times are marked A1, A2, b1 and b2 in the display.
If all four passages are not occurring, the series can be interrupted by pressing the *Start*/*Stop* button.

The result is reset by pressing the *Select key* – wait a moment, then press *Start*/*Stop*. Now the device is ready for a new collision experiment.

Acceleration

This function is used with two photocells a car or cart equipped with a ”tab” that can interrupt the light to the photocell. The device times two such interruptions. Furthermore the time interval between switching off photocell A resp. photocell B is measured.

The velocities of the cart at two photocells are determined as the plume length, divided by the passage time. The average acceleration is determined as the difference between the two speeds, divided by the time between the two speed measurements.

Press the *Select* button repeatedly until the *Acceleration* LED is lit. Wait a moment and press *Start/Stop*.
The setup is now ready.

The first test result will remain in the display until all data is recorded. Once photocell A and then B has been interrupted, the first passage time of input A is shown. The other times called up by pressing *Memory*/*Continuous*. The times are marked A1, b1 and Ab.
The measuring series can be interrupted by pressing the *Start*/*Stop* button.

The result is reset by pressing the *Select* key – wait a moment, then press *Start*/*Stop*. Now the device is ready for a new acceleration experiment.

Period

This function is used for instance with a photocell and an object that moves periodically and interrupts the light in the photo cell. Electrical signals or audio signals via a microphone can also be measured. Use input A.

The device can operate in two different modes that are best explained by a few examples:

With rotating objects you can fit a small ”tab” that interrupts the photocell once per. revolution. The measurement shows directly the period of rotation. This situation corresponds to mode ”A”.

For pendulums, the amplitude is often so large that the pendulum swings completely through the photocell beam twice per period of oscillation. In order to be able to directly read off the period it is required that the timer skips every other passage of the photocell. This situation corresponds to the mode ”B”.

The counter is usually in mode ”A”. To put the unit into mode ”B”, keep the *Select* button pressed while switching on with the *On*/*Off* switch. The mode remains unchanged until you switch off again.

In state ”A”, measurements lasts for two oscillations – the result shown is the average.
In state ”B” – for inscrutable reasons – results are shown for every third pulse – but the figure corresponds as described to the time between every second pulse.

Press the *Select* button repeatedly until the *Period* LED is lit. After a short time the *Continuous* LED will flash and normally you will now press *Memory*/*Continuous* to achieve continuously repeated measurements.

Press the *Start*/*Stop* button to start the measurement.

Measurements are stored in the internal memory – see later.

Frequency

This function is used to determine the frequency of a simple periodic signal. Electrical sine or square wave signals connected to pulse input A works fine. In order to work with audio through a microphone, the sound must be strong and look like a sine wave. In other words, the sound should be without overtones. Sounds with strong overtone content cannot be used with this counter.

Press the *Select* button repeatedly until the *Period* LED is lit. After a short time the *Continuous* LED will flash and normally you will now press *Memory*/*Continuous* to achieve continuously repeated measurements.

Press the *Start*/*Stop* button to start the measurement.

Measurements are stored in the internal memory - see later.

Counts

This function is typically used when working with radioactivity. Use input A.

With the *Count* function, the measurement time interval must be selected. A typical time interval for demonstration tests and many student labs is 10 s.

Accurate measurements may require longer intervals like 60 s or 100 s. Even longer time intervals can be achieved by simply making multiple measurements and adding the results. If very long measurement periods are necessary, you can use manual start and stop.

Press the *Select* button repeatedly until the *Count* LED is lit. Afterwards the *Select* button switches between the possible time intervals. “Start/Stop” means manual start and stop, the setting “Special” is not used.

Shortly after you select the measurement period, the *Continuous* LED flashes and normally you will now press the *Memory*/*Continuous* to achieve continuously repeated measurements. Measurements will be stored in the built-in memory – see later.

Press the *Start*/*Stop* button to start the measurement.

When in continuous mode, the counting initially runs for, say, 10 seconds. Next, the result is displayed for 3 seconds while the next measurement is already underway. The next 7 seconds of the counting is followed ”live”, and then the result is displayed for 3 seconds – etc.

The shortest counting interval leaves no time for readout, but the data can later be retrieved from memory.

After a single measurement, the display is reset by pressing *Select* once. The unit is now ready for a new measurement.

A *Continuous* series of measurements is terminated by pressing the *Start*/*Stop* button. The current measurement continues until the end before stopping. Instant stop is achieved by pressing *Select*.

Memory

The functions *Collision* and *Acceleration* use the memory as described previously.

All the other functions continuously save the results in memory. There is access to browse the memory when the LED next to *Memory*/*Continuous* is flashing. This requires that a measurement is not in progress.

Each press of the button *Memory*/*Continuous* steps ”backwards” from newest to oldest results. When you have reached the end, the symbol ”--------” is displayed; after that the sequence is started over again.

There is room for 50 numbers in memory, oldest entries will be overwritten.

Pressing *Select* resets the memory.

TECHNICAL SPECIFICATIONS

Jack connector

The external equipment is powered by 5 V (max. 1 A), delivered to the Tip of the plug. See figure.

The Ring of the plug is the signal fed into the counter.

Triggering occurs on the falling slope at c. 2 V.

The Sleeve is ground

The DIN connector

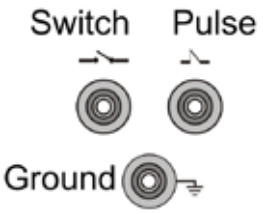
1. Ground
2. +8V
3. Photo
4. 6.3 V AC
5. 6.3 V AC
6. Microphone

The two supply voltages have a max. load of 1 A.

The *Microphone* input triggers on the falling slope at c. 0.5 V. Sensitivity can be raised about 10 dB by shorting the *Photo* input to ground.

Apart from this, the *Photo* input is strongly specialized for use with Frederiksen's photocell units.

Switch input



Triggering occurs on the rising slope – i.e. when the switch breaks – at c. 1.2 V.

When the switch is open, the input is pulled up to c. 7.4 V which must be taken into account if an electronic switch is used instead of a mechanical one. The generator impedance is c. 7.6 kΩ.

Pulse input

Triggering occurs on a falling slope at c. 70 mV (input A) resp. 1.7 V (input B). The maximum peak voltage tolerated is 50 V resp. 100 V for inputs A and B.

Mains power

The counter is powered by 230 V AC

The unit must be grounded and is provided with a grounded power cord.