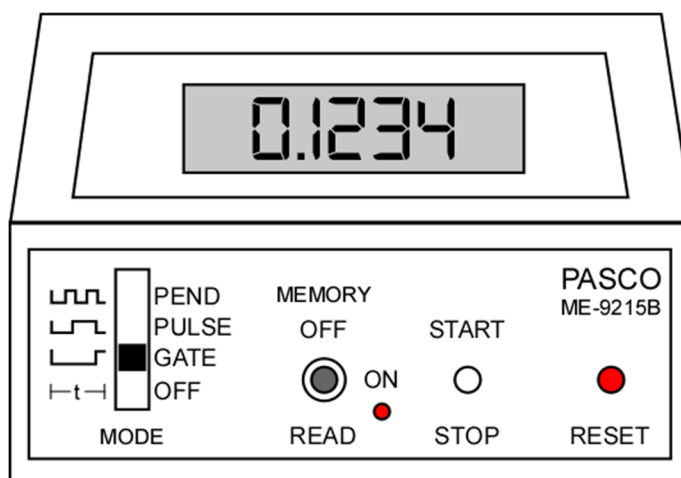# Using a Photogate Timer

In this course we will frequently use a *photogate timer* as a stopwatch to measure the time of certain events. There are several timing modes available, so it is important that you choose the correct mode for the experiment in question. The sketch below shows the control panel on the *Pasco Photogate Timer* that we will be using:



## Selecting the Timer Mode:

Slide the switch on the left side of the timer to the appropriate position to select one of the three modes available; it is always a good idea to test the timer with your hand or finger to make sure you have selected the correct mode:

- *Gate*: In this mode, the display indicates the length of time that the photogate beam is interrupted. If you pass your hand slowly through the beam, the timer starts counting when your hand first enters the beam, then stops when your hand exits the beam. So, if the beam is interrupted by a flag attached to an object, and you know the length of that flag, you can calculate the velocity of the object as it passed through the photogate (but is it an *instantaneous* velocity? Hmm…).

- *Pulse*: In this mode, the display indicates the amount of time that has elapsed since the timer was started. The timer starts when the beam is interrupted, then stops when it is interrupted a second time. The timer can also be started manually by pressing the white Start/Stop button and it will stop when an object breaks the photogate beam. If the timer is connected to a second (accessory) photogate, it is started by the object passing through the first photogate and stopped by the object passing through the second photogate.

- *Pend*: In this mode, the period of a pendulum is measured. The timer starts the first time the pendulum passes through the photogate beam, continues to count when the pendulum passes through a second time on the backswing, and stops when the pendulum breaks the beam a third time.

**Measurement Precision:**

   The photogates you will be using record time in seconds with a precision of 0.1 *millisecond* (0.0001 *seconds*). They can record events up to 19.9999 seconds in length. *It is important that you record all digits that appear on the timer for your measurements; don't round off the displayed value.*

**Timer Memory:**

   There are also two buttons and a toggle switch on the control panel. The red button will reset the timer to zero, and should be pressed before each new reading. The white button allows you to start and stop the timer manually. The silver toggle switch controls the memory function of the timer. In this course, you will **always** leave the toggle switch in the *On* position (the red LED on the control panel that will stay lit.) In this mode, the display will "freeze" when the timer has stopped, giving you the opportunity to write the time in your journal even if the photogate beam is interrupted again. If the Memory switch is turned *Off*, the timer will start and stop every time the beam is interrupted.

   You can use the memory function to record the total amount of time the photogate beam is interrupted, which is especially useful if you have an object that passes through the photogate twice. The display will freeze on the first amount of time that is recorded, but the internal memory will continue to record the second interval of time the beam is interrupted. If you then pull the toggle switch toward you and release it, the display will show the *total* amount of time (first and second pass) that the beam is interrupted. Subtracting the first time from this total time will give you the amount of time that the beam was interrupted during the second pass through the photogate.

   The memory function works in both the *Gate* and *Pulse* modes, but not the *Pend* mode.

**Aligning the Photogate:**

   You will note that there is another red LED located on top of the photogate itself. This LED will glow whenever the beam is interrupted. This is useful when you wish to position the photogate so that a cart on a track interrupts the beam at a particular position along the track, but the cart's flag is not flush with the cart end. Place the cart at the desired point on the track, and move the photogate timer toward the front edge of the carts' flag. When the LED on the photogate just comes on, the timer will be in the correct position.