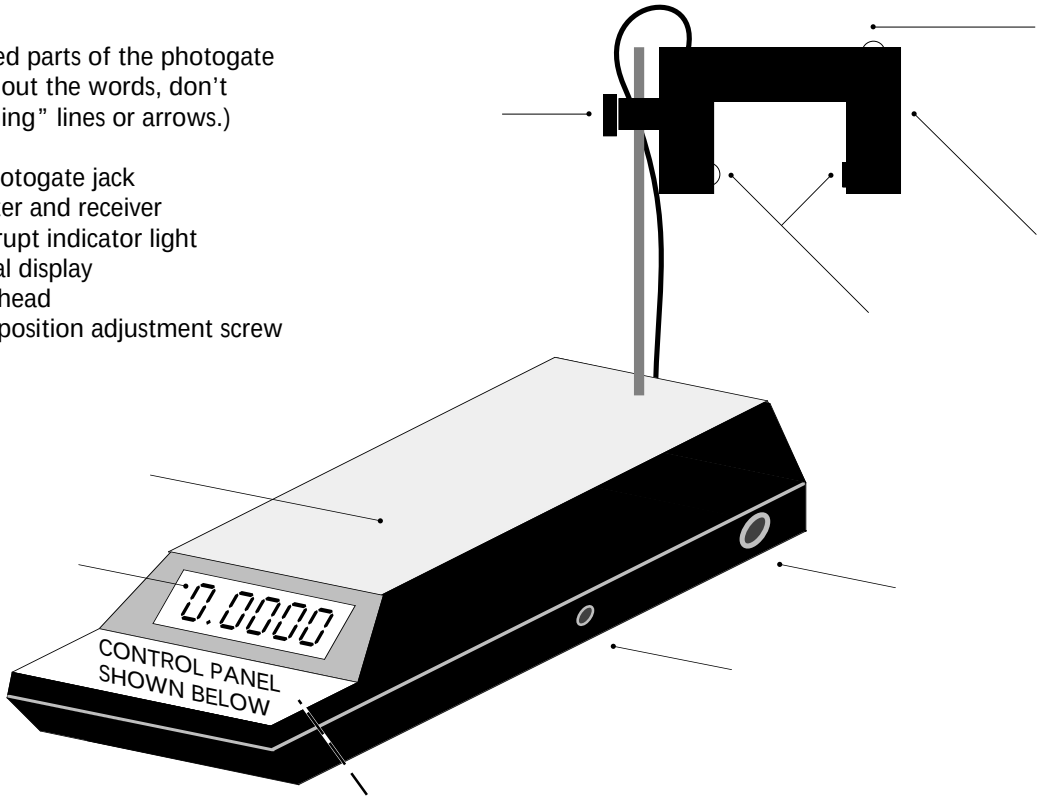
PhyzLab: Photogate Timer

an investigation of the photogate timer

• • • ALWAYS USE PENCIL ON LABS • • •

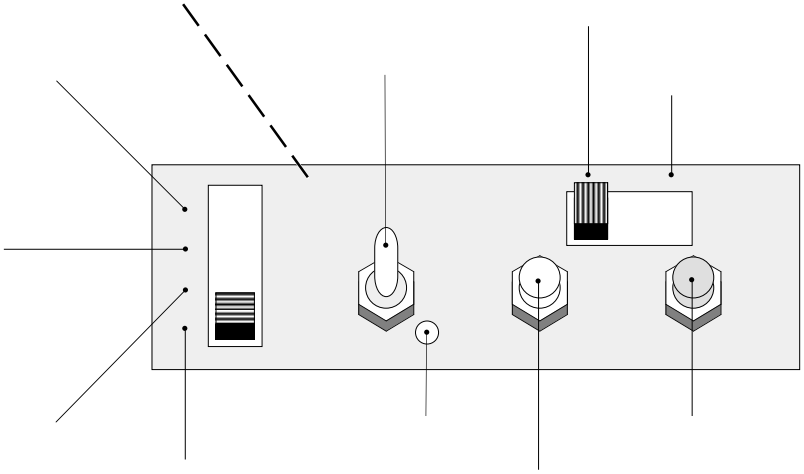
1. WHATSIT?
Label the listed parts of the photogate timer. (Write out the words, don't draw "matching" lines or arrows.)

- auxiliary photogate jack
- beam emitter and receiver
- beam interrupt indicator light
- liquid crystal display
- photogate head
- photogate position adjustment screw
- power jack
- timer case



Label each item on the control panel. (Identify modes by name, not symbol.)

- 0.1mS
- 1mS
- GATE
- Memory On Light
- Memory Read
- OFF
- PEND
- PULSE
- Reset
- START/STOP



IMPORTANT: A photogate TIMER only measures one quantity. What is that quantity? _____.

db

2. WHATSIT DO?
What does each item on the control panel do? Complete the following section to find out.

a. TIMER MODE
Exercise: Turn the photogate timer on in GATE mode and press the reset button. Slowly wave a finger repeatedly in and out of the photogate beam. Change the mode to PULSE, press the reset button, and wave the finger back and forth again. Repeat the exercise with the timer in PEND mode. Now describe the differences between the modes.

i. GATE: Timer starts when...

and stops when...

So the readout shows...*

ii. PULSE: Timer starts when...

and stops when...

So the readout shows...*

iii. PEND: Timer starts when...

and stops when...

So the readout shows...*

b. RESOLUTION
Exercise 1: With the photogate timer in GATE mode and the resolution switch in the 1ms position, try to interrupt the beam such that the display reads 1.000 (or something close to that). To do so, how long must you interrupt the beam?

Now switch the resolution to 0.1ms, press the reset button, and repeat the exercise so as to obtain a display of 1.0000 (or something close to that). To do so, how long must you interrupt the beam?

i What are the units of the readout when the resolution switch is in the 1ms mode?

ii. What are the units of the readout when the resolution switch is in the 0.1ms mode?

iii. What is meant by the abbreviation, "ms"? (Hints: notice the abbreviation is not "m/s"; what is meant by the abbreviation, "mm"?)

iv. What is the smallest interval that could be recorded when the resolution switch is in the 1ms position? Write your answer first as the readout would display it (with units), then in scientific notation, then in SI prefix notation.

Smallest interval as displayed...	...in scientific notation...	...and in SI prefix notation

*Exercise 2: With the timer in the **less precise** resolution setting and in GATE mode, interrupt the beam for about 5s. Repeat with the timer in the **more precise** resolution mode.*

v. Under what circumstances—if any—would you choose to use the **low-precision** mode?

c. MEMORY

Exercise 1: With memory OFF and the timer in GATE mode, wave your finger back and forth through the photogate beam and watch the readout. Switch the memory ON, press reset, and repeat.

i. Does memory have an effect on the behavior of the readout? If so, what effect?

Exercise 2: Without changing the settings from the previous exercise, press the reset button. Move a finger through the beam one way and then through the beam again on the way back. While watching the readout, push the memory toggle into the READ position (it will spring back on its own). Continue to experiment until you understand what the memory function does

ii. Describe the function of the memory.

d. START/STOP

Does the START/STOP button work the same way in each timer mode? Explain.

3. HOW SPEEDY ARE YOUR DIGITS?

The speed of an object can be calculated by dividing the distance it travels by the time it takes to travel that distance.

a. Determine a way to use the photogate timer to determine the speed at which you can flick your finger through the photogate beam. Describe your procedure.

b. Record your data, and calculations.

4. ADD A GATE

Obtain an auxiliary photogate. Plug it in. (All the way!) In what mode (GATE, PULSE, or PEND) is the auxiliary photogate most useful?

5. LIFT OFF

Lift up the photogate timer and observe the inscription on the bottom. Have a nice day!