

ET-41 Electronic Stop Clock



Introduction

The ET-41 Electronic Stop clock has a 4 digit LCD display and it records times in either milliseconds (ms) or seconds (s) to 0.001 s. The display changes from ms to s automatically during the execution of an experiment. One or two photogates can control the clock, providing the option of timing the interruption of the gate or the time of passage between the two gates. The clock has two input jack connectors on the front of the panel (P1 and P2), providing power for two photogates as well as receiving signals from them. The front panel incorporates a reset button, recall button and on/off toggle power switch.

A photogate or an included external push-button switch (ET-21) controls the stop clock. The clock starts as the light beam is broken and stops when the beam is clear. This is useful in mechanics experiments, where the velocity of a body needs to be determined at some point in its travel. When two photogates are connected, the clock starts when the first gate's sensors are passed and stops when the second gate is broken. The clock's internal logic senses the connection of the second gate and operates the clock accordingly.

The memory feature of the stop clock is provided for use with a single gate. In this mode, timing begins with interruption of the gate. The display will show the total time that the gate was blocked and hold this value until the gate is interrupted a second time. After the second measurement is complete, the time recorded during the first interruption may be read by pressing the "recall" button.

Specifications

Timing range	milliseconds (ms) and seconds (s)
Display	LCD
Control	One or two ET-45 photogates (one included), manual pushbutton (included)
Modes	Reset and recall

Operation

1. Connect the ET-41 Electronic Stop Clock to the correct power supply using a power adapter (DC 5V/1A).
2. Using the silver toggle switch, turn the unit from the off to the on position.
3. The device includes one photogate, and two telephone cable connectors. One telephone cable connector has the ET-41 pushbutton attached.

Single Photogate Operation

1. Connect the ET-41 Electronic Stop Clock to the correct power supply using a power adapter (DC 5V/1A).
2. Using the silver toggle switch, turn the unit from the off to the on position.
3. Press the reset button. The display should read 0.0 ms.
4. Connect the photogate to the ET-41. Plug one end of the telephone cable connector into the P1 jack on the front of the unit and the other end of the cable connector to the photogate. Place the photogate on a flat surface.
5. To test the operation, reset the display and break the beam with your hand to verify that the clock runs when the beam is broken.

The timer will continue to run until the reset button is pressed again. Note that the LED display automatically switches from ms to s. Reset the display so that it reads 0.0 ms.

6. Place the photogate so that the object to be time will break the beam. If used on an air track, position the gate so that the vertical spine on the glider interrupts the light beam above the bumper spring.
7. When a body passes through the gate, the display will start running, showing the time, and continue until the reset button is pressed.
8. The Electronic Stop Clock can be operated with a manual pushbutton switch (ET-21). Connect the included ET-21 pushbutton switch to the P2 jack on the front of the unit. When performing a single photogate operation, simply press the red button on the switch when the object (e.g., ball or glider) has passed through the photogate sensors. The velocity of the object can be calculated as follows: $\text{velocity} = \text{distance}/\text{time}$. It is a vector quantity, so be sure to specify the direction.
9. Press the reset button to clear both the display and the memory for the next repetition of the experiment.

Two Photogate Operation

1. Connect the ET-41 Electronic Stop Clock to the correct power supply using a power adapter (DC 5V/1A).
2. Using the silver toggle switch, turn the unit from the off to the on position.
3. Press the reset button. The display should read 0.0 ms.
4. Connect the first photogate to the ET-41. Plug one end of the telephone cable connector into the P1 jack on the front of the unit and the other end of the cable connector to the photogate. Place the photogate on a flat surface.
5. Connect the second photogate to the ET-41. Plug one end of the telephone cable connector into the P2 jack on the front of the unit and the other end of the cable connector to the photogate. Place the photogate on a flat surface.
6. Carefully measure the distance between the photogates. You can assume that the LED and photodiode are centered in their modules.
7. Reset the display to zero and then carry out the experiment. Several repetitions are desirable to establish an estimate of the variability of the data.
8. With the two photogate configuration, the clock will start when the first gate is broken and continue until the second gate is broken.
9. Two gate measure are useful if the average velocity over an appreciable distance is to be measured.