611-0104 Air Track Smart Timer

Additional Materials (Optional)

- Air Track with Accessory Kit

Warranty, Replacement Parts:

We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

Introduction:

The purpose of this device is to allow precise timing of physics motion experiments with Air Tracks.

The 611-0104 Smart Timer has seven separate functions and may be used to count time, measure acceleration when used with air track and collision devices. The 611-0104 uses a six digit LCD and has a timer range up to 9999 milliseconds, with an accuracy of 1/100th of a millisecond. The timer conveniently displays its functions with a large graphical user interface.

How to use:

The Timer must be assembled prior to use. Begin by plugging the photogate cord into the back of the Timer. Next, plug the power supply into the back of the Timer. Press the on button and you are ready to use your Timer.

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The Timer has 3 control buttons:

The ***Model/Reset*** button allows the user to clear the memory and then select which timer function they wish to use.

The ***Memory*** button will cycle through the stored memory of times of various events.

The ***On/Off*** button will turn the timer on and off.

The photogates used with this timer use an optical "beam" to trigger the timer to record an event. When an object passes through a photogate, it is referred to as the photogate being "interrupted". This interruption will be recorded in a manner determined by the function being used.

When performing experiments with the photogates, it is important that the object that is interrupting the photogate have straight smooth edges, and a length (width) that can be accurately measured. Different timer flags are part of the accessory package of our Air Tracks. It is also important that the photogates are "square" to the experiment being performed so that the timing is not distorted.

Smart Photogate Timer Functions:

1. Timing I

The Timing I function only uses photogate 1. Press the function button until Timing I is displayed. From this point on the timer is ready for photogate 1 to be tripped. The Timing I function will store up to 10 data points in its memory. The data points will be the time in which the photogate was interrupted. To access the stored data points, press the recall button. This will cause the timer to display the series of time data points as ***P1.1***, then ***P1.2***, and so on until ***P1.10***.

With the time shown on the timer, and the length of the article passing the photogate, the velocity may be measured for each data point using V=L/T. Where V is the velocity, L is the length of the object breaking the photogate, and T is the time reading from the timer.

If a picket fence accelerating due to gravity is being passed through the photogate, the individual velocities calculated above may be graphed to show the acceleration due to gravity A=V/T. Where A is the acceleration, V is the velocity, and T is the time.

2. Timing II

The Timing II function uses both photogate 1 and photogate 2 in a series. The function will measure the time between photogate 1 being tripped and photogate 2 being tripped. This function is useful for measuring the time of motion between two discrete points.

3. Collision

The Collision function uses both photogate 1 and photogate 2 in a series. The function is designed to work with an air track, but may be used with dynamics cars as well. The function depends on two masses (air track carts), either equal or unequal in mass, being launched to impact at a point between the photogates. Each mass must launch from a given distance from impact, and pass through their respective photogates once before impact, and once after impact for elastic collisions.

The timer will display the data points with the following output:

P1.1 is the photogate interrupt time for the first (launching) pass through photogate 1.

P1.2 is the photogate interrupt time for the second (returning) pass through photogate 1.

P2.1 is the photogate interrupt time for the first (launching) pass through photogate 2.

P2.2 is the photogate interrupt time for the second (returning) pass through photogate 2.

If an inelastic collision takes place, and one of the masses passes through its opposite photogate (for a total of three passes through that gate), the timer will list a time of P1.3 instead of P2.2.

The velocity of each pass may be measured as V=L/T, here V is the velocity, L is the length of the object interrupting the photogate, and T is the time reading from the timer.

4. Acceleration

The Acceleration function uses both photogate 1 and photogate 2 in a series. The accelleration function requires the use of a U-shaped trigger which will double trigger each gate. The function will display the following measurements as the photogates are interrupted:

1 is the time that photogate 1 was interrupted.

2 is the time that photogate 2 was interrupted.

1-2 is the time in between the two photogates.

The velocities at the individual photogates may be calculated as before (see function 1. Timing I) using V=L/T.

The Acceleration may be calculated using $A=(V_f-V_i)/T$. Where A is the acceleration, V_f is the final (second) velocity, V_i is the initial (first) velocity, and T is the time between the two.

5. Count

The count function uses photogate 1 to register a count on the timer every time the photogate is interrupted. The count range is 1 to 9999.

611-0104 Smart Photogate Timer Curriculum
Content: Physical Science Standards
Grades 5-8: *Motions and forces*
Grades 9-12: *Motions and forces*