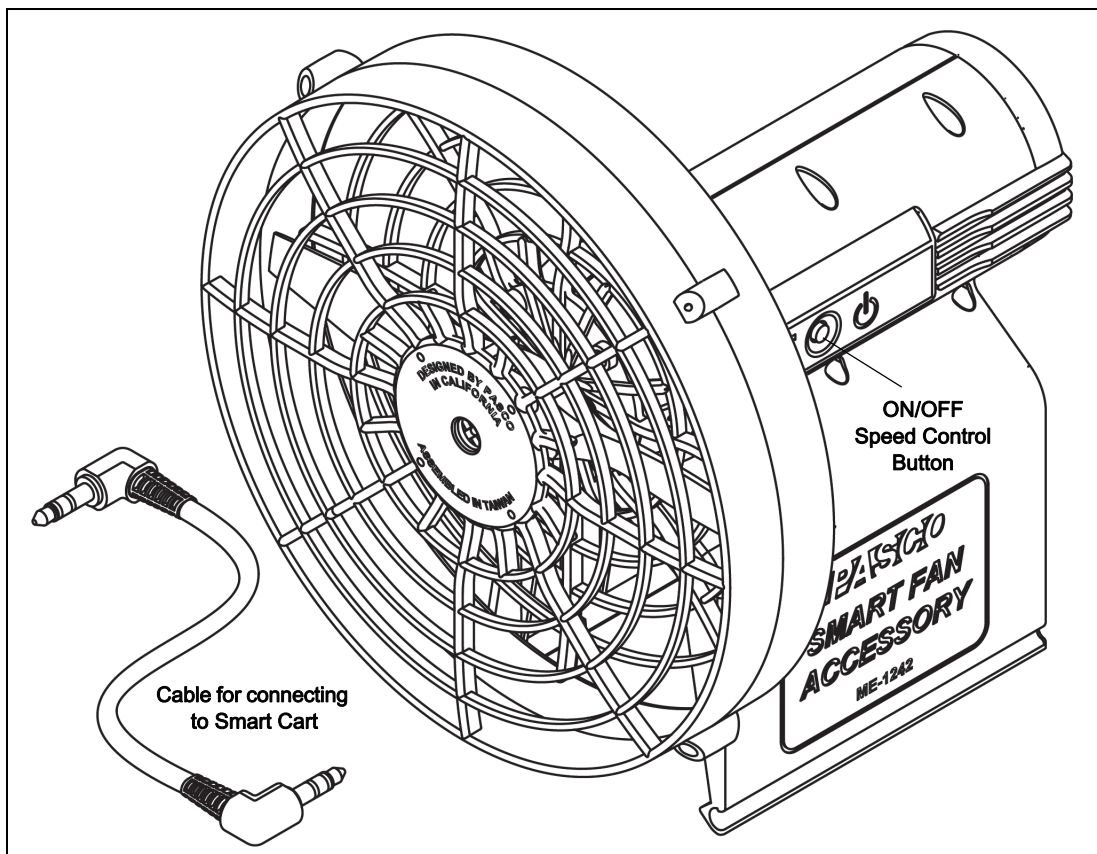


Smart Fan Accessory

ME-1242



Included Equipment	Part Number
Smart Fan Accessory	ME-1242
Cable for connecting to Smart Cart (19 cm)	
Battery, AA-Cell (4 not shown)	
Highly Recommended Equipment	Part Number
Wireless Smart Cart	ME-1240 or ME-1241

OR

PASCO Cart	see www.pasco.com
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Suggested Equipment	Part Number
PASCO Track	see www.pasco.com
PASCO Data Collection Software	see www.pasco.com

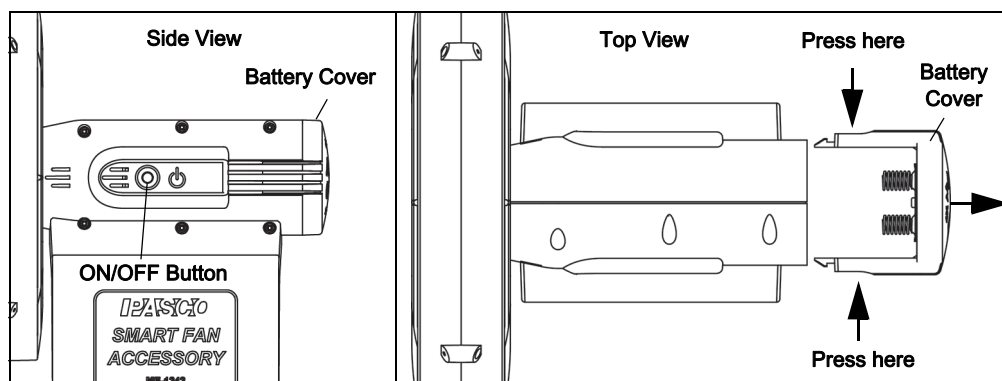
Introduction

The PASCO ME-1242 Smart Fan Accessory mounts on any PASCO Cart for use with or without a PASCO Track (see www.pasco.com) to demonstrate principles of motion. However, the Smart Fan Accessory is specifically designed to work with the PASCO Wireless Smart Cart (ME-1240 or ME-1241). The Smart Cart includes four on-board sensors: motion encoder for measuring position or velocity, a 3-axis accelerometer, a 3-axis gyroscope, and a force sensor. All of the sensors can transmit data wirelessly in real time to a computing device (e.g., table, smart phone, or computer) that has PASCO Data Collection Software.

The self-propelled Smart Fan Accessory facilitates students' understanding of Newton's Second Law of Motion because the fan produces the applied force, and all the mass of the system is in one place. The force can be adjusted for a variety of experiments because the Smart Fan Accessory ON/OFF button also controls the fan speed. The mass can be adjusted by adding masses (such as the ME-6757A PAS-car Cart Mass - set of 2) to the accessory tray of a PASCO Cart.

Install Batteries

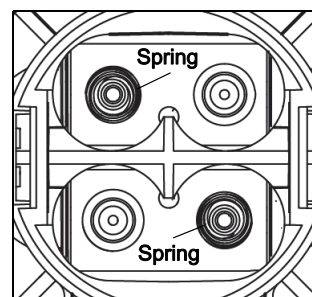
The Smart Fan Accessory requires four "AA-cell" batteries, either alkaline (included) or rechargeable (such as nickel-metal hydride). To install the batteries, remove the battery cover from the end of the Smart Fan Accessory. Press in on the sides of the Battery Cover and pull it away from the accessory.



Insert the four batteries into the battery compartment. (See the illustrations on the inside of the battery compartment.) The positive (+) "button" end of a battery goes into the section that does not have a spring.

Note: A feature of the Smart Cart is that it has reverse battery protection, so if batteries are installed incorrectly, the Smart Cart will not be harmed if the Smart Fan Accessory is connected.

Return the Battery Cover to the end of the Smart Fan Accessory.



Assembly

The figure shows how to attach the Smart Fan Accessory over the rails on the accessory tray of the PASCO Wireless Smart Cart. Use the same method to attach the Smart Fan Accessory to any PASCO Cart.

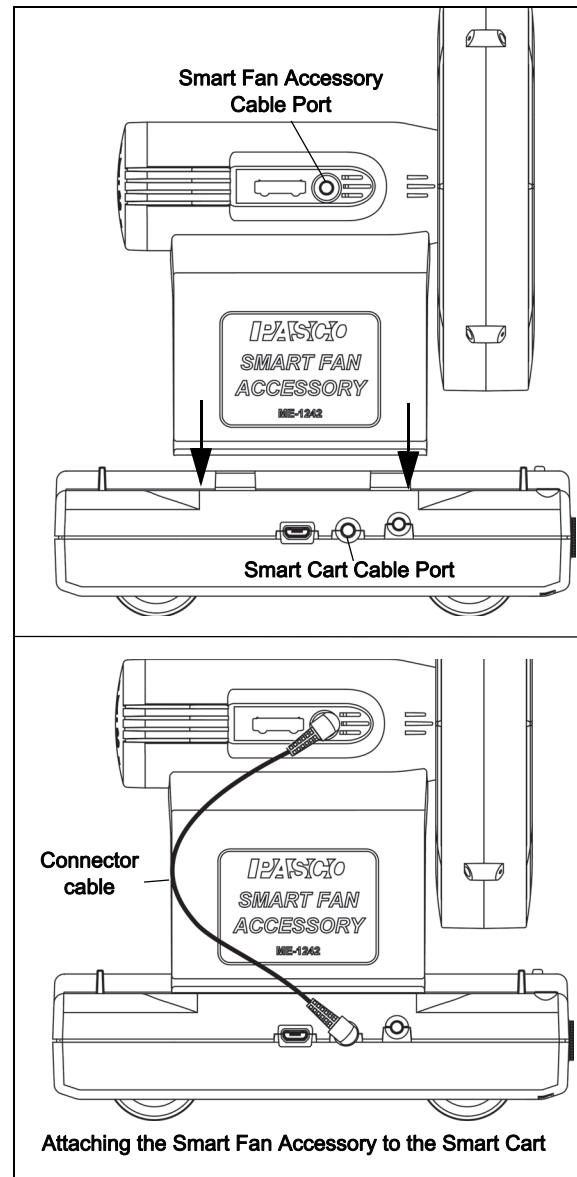
Operation

1. Press the ON/OFF Speed Control Button to start the fan.
 - The fan starts at low speed.
2. After starting the Smart Fan Accessory, change the fan speed by pressing the ON/OFF Speed Control Button.
 - One press changes the fan speed from low to medium, a second press changes it from medium to high, and a third press returns it to low.
3. Press and temporarily HOLD the ON/OFF button to stop the fan.

The fan turns in one direction when used in the manual mode. When used with a Smart Cart, the Smart Fan Accessory is able to switch the fan direction.

Using the Smart Fan Accessory with the Smart Cart

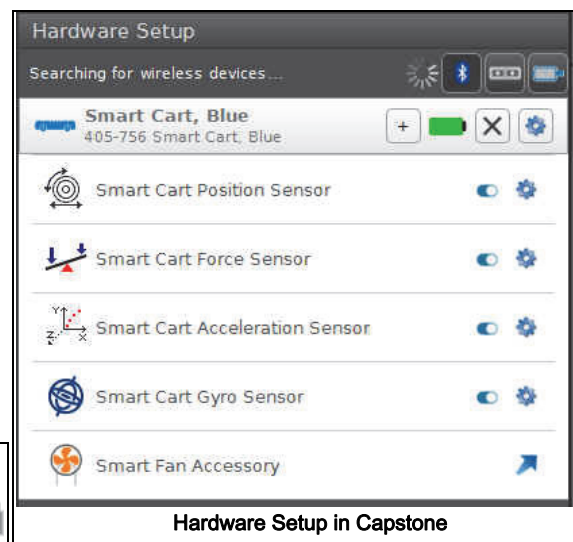
Connect the Smart Fan Accessory so it can be controlled by the Smart Cart by plugging the included cable into the cable ports on the accessory and the cart.



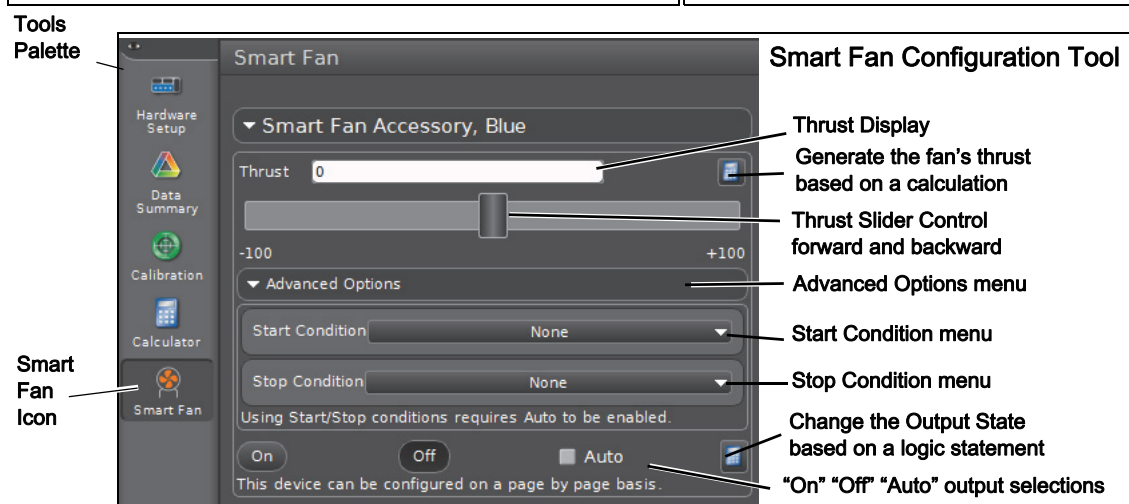
Start the PASCO Data Collection Software (Capstone). Turn on the Smart Cart and use the software to wirelessly “pair” (connect) it to the computing device from inside the “Hardware Setup” pane. (See the software Help system for more information about connecting the Smart Cart.)

Smart Fan Accessory Configuration

Select the arrow next to “Smart Fan Accessory” to open the Smart Fan Accessory Configuration Tool, or select the “Smart Fan” icon from the Tools palette.



Hardware Setup in Capstone



- The fan in the Smart Fan Accessory can provide forward or backward thrust. The amount of thrust (-100 percent to +100 percent) and the direction are controlled by the Slider Control. The amount and direction can also be entered as text in the Thrust Display (for example, “+35”).
- Under the “Advanced Options” menu are the “Start Condition” and “Stop Condition” menus.
- Use the “On” and “Off” output selections to turn the fan on or off. Enable the “Auto” output selection to allow the “Start Condition” and “Stop Condition” or calculations to control the fan.

Start/Stop Conditions and Calculations

Start/Stop Conditions and Calculations are designed to support remote “sense-and-control” operation of the Smart Fan Accessory when it is used with the Wireless Smart Cart. Calculations can be written that rely upon the measurements from the on-board sensors of the Smart Cart, or other sensors that can be used with the PASCO Data Collection Software. For example, the Smart Fan Accessory could be instructed to start its fan when the Data Collection Software measures a temperature that rises above a set value.

Start Condition and Stop Condition

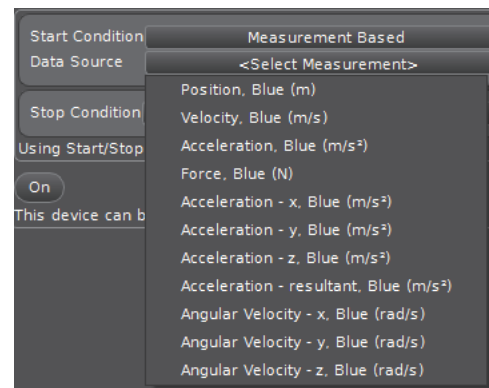
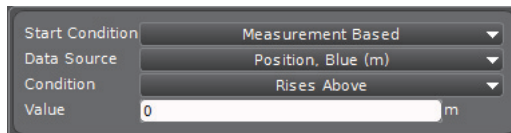
The menus for both the Start Condition and the Stop Condition show three choices. The default choice is “None”:



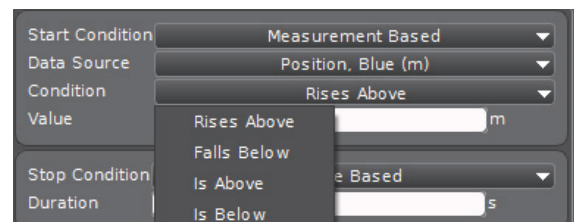
The other choices for Start or Stop Conditions are “Measurement Based” or “Time Based”.

A Measurement Based condition depends on the sensors that are being used. For example, if the Smart Fan Accessory is attached to a Wireless Smart Cart, the Data Source menu shows all the measurements possible with the Smart Cart’s built-in sensors (for example, position and velocity).

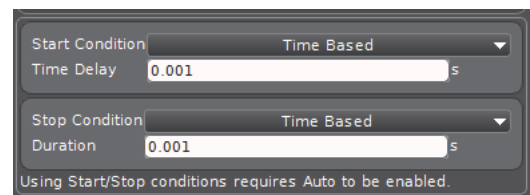
Once a measurement is selected, the Start Condition window changes to show “Condition” and “Value”.



The Condition choices are “Rises Above”, Falls Below”, “Is Above” and “Is Below”. The “Value” text box shows the unit of measurement (and because Position is the selected measurement in this case, the unit is “m” for meters). After the Condition is selected, enter the value in the “Value” text box.



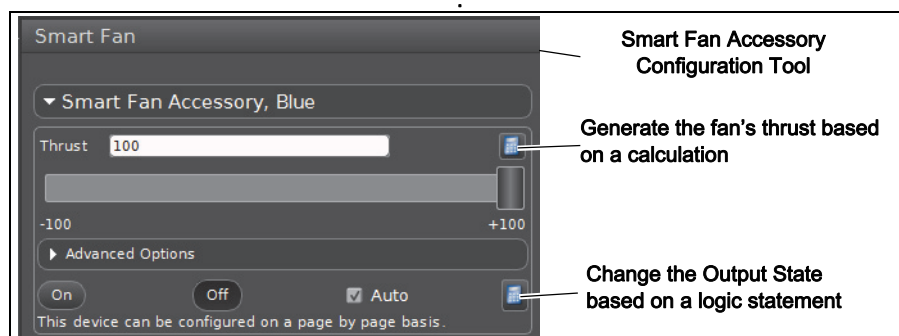
A Time Based condition controls the amount of time that the computing device will “wait” before recording data and the duration of the recording time. The Time Delay minimum default value is 0.001 s and the Duration minimum default value is 0.001 s. The Time Delay and Duration do not have a maximum limit.



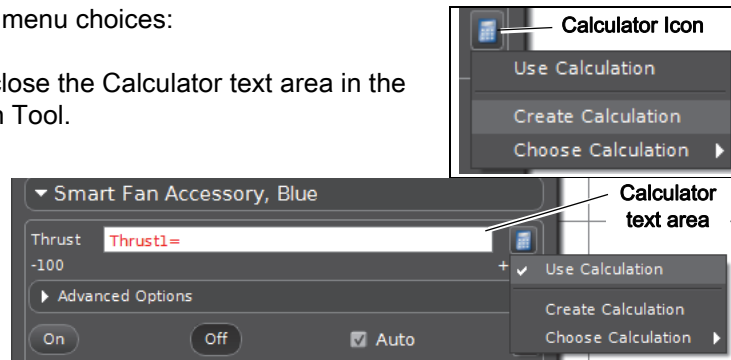
Measurement Based and Time Based conditions can be used together. For example, the Start Condition could be a Time Delay, and the Stop Condition could be when the measured distance “Rises Above” a certain value.

Calculations

There are two Calculator icons in the Smart Fan Accessory Configuration Tool

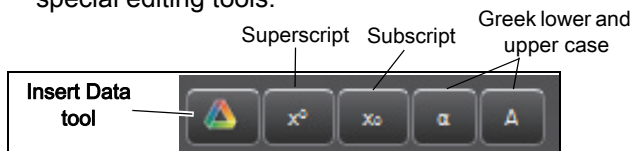


- Click the Calculator icon to see the menu choices:
- Click “Use Calculation” to open or close the Calculator text area in the Smart Fan Accessory Configuration Tool.
- After the Calculator text area opens, a check-mark appears in front of “Use Calculation”. Click “Use Calculation” again to close the Calculator text area.
- “Create Calculation” means to build a calculation using the Calculator Tool. Click “Create Calculation” to open the Calculator text area. (A check-mark appears in front of “Use Calculation”. Click “Use Calculation” to close the Calculator text area.)
- “Choose Calculation” means to select a previously created calculation from a list.

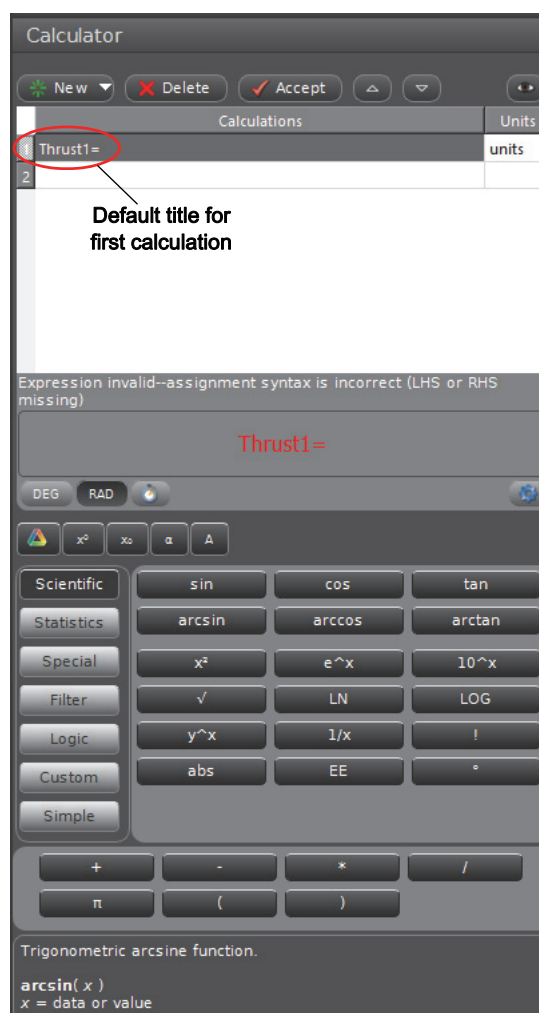


You can create your calculation in the Calculator text box inside the Smart Fan Accessory window, or click the Calculator icon in the Tools palette to open the Calculator window. (See the software Help system for more information.)

- The top part of the Calculator window shows a list of Calculations. (In this example, the list shows “Thrust1=”. Below the list is a row of buttons for selecting degrees (DEG), radians (RAD) or “Timer Mode”, and “Edit Calculation Properties”.
- The lower part of the window starts with a row of special editing tools.



- Below the tools are the types of calculators, the calculator functions, basic arithmetic functions and the text area that shows information about each of the calculator functions.



Example Calculation with Start Condition

This example assumes that the Smart Fan Accessory is connected to a Smart Cart, and the Smart Cart is wirelessly connected to a computing device.

In the Calculator text area, create an equation as follows. First, enter “-100”. Second, click the “Insert Data” editing tool and select “Position, Blue (m)” from the menu. Third, click the “Accept” button.

- Thrust1=-100[Position, Blue (m)]

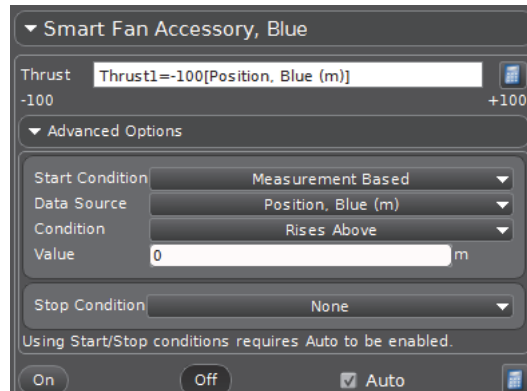
Under Advanced Options, set the Start Condition to “Measurement Based”, the Data Source to “Position, Blue (m)”, the Condition to “Rises Above”, and the Value to “0”. Set the Stop Condition to “None”.

Check the box for “Auto”.

Place the Smart Cart in the middle of a level track or on a horizontal surface. In the software, select “Record”. Move the Smart Cart in a straight line a short distance (such as 30 to 50 cm) away from its starting position, and then let go of the cart.

As soon as the Smart Cart is moved away from its starting position, the fan will come on and provide thrust to return the cart. However, the cart will pass the starting position and the fan will reverse direction to push the cart back toward the starting position again.

Note: Due to the aerodynamics of the Smart Fan Accessory, the thrust in one direction will be more effective than the thrust in the opposite direction.



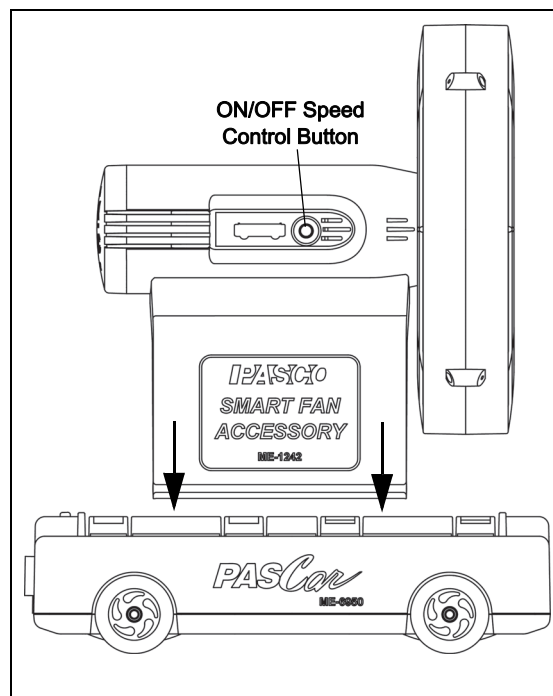
Using the Smart Fan Accessory with a Dynamics Cart

Assembly

As with the Smart Cart, snap the sides of the Smart Fan Accessory over the rails of the Accessory Cart of the PASCO Dynamics Cart.

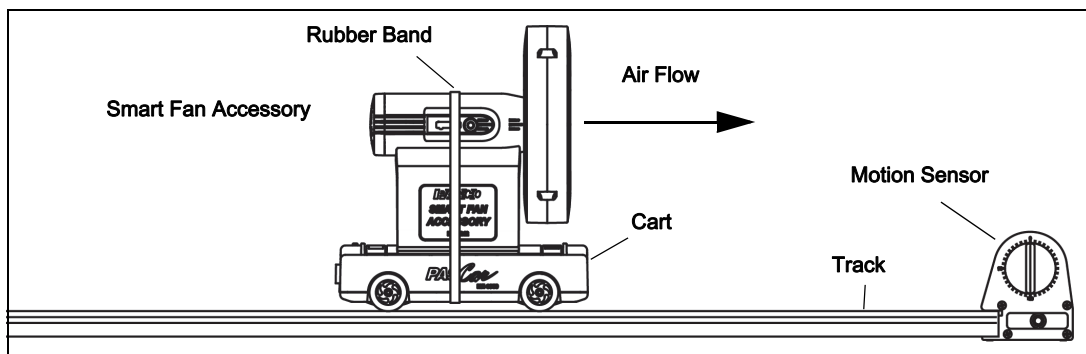
Operation

1. Press the ON/OFF Speed Control Button to start the fan.
 - The fan starts at low speed.
2. After starting the Smart Fan Accessory, change the fan speed by pressing the ON/OFF Speed Control Button as follows:
 - One press changes the fan speed from low to medium, a second press changes it from medium to high, and a third press returns it to low.
3. Press and temporarily HOLD the ON/OFF button to stop the fan.



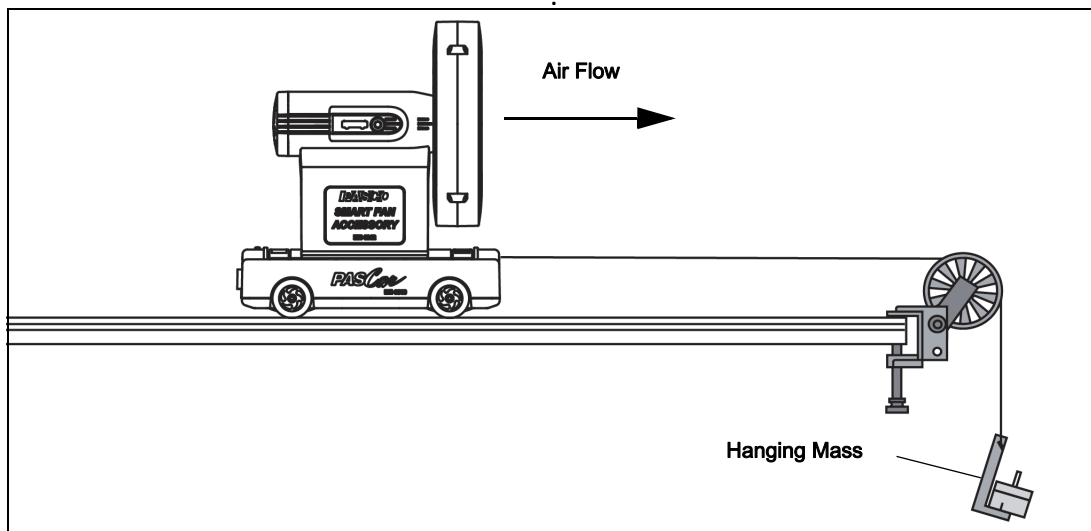
Suggested Experiments

Experiment #1: Measure the acceleration of the cart with the Smart Fan Accessory using the a Motion Sensor (or equivalent). Vary the mass of the cart or the fan speed of the propeller and repeat.

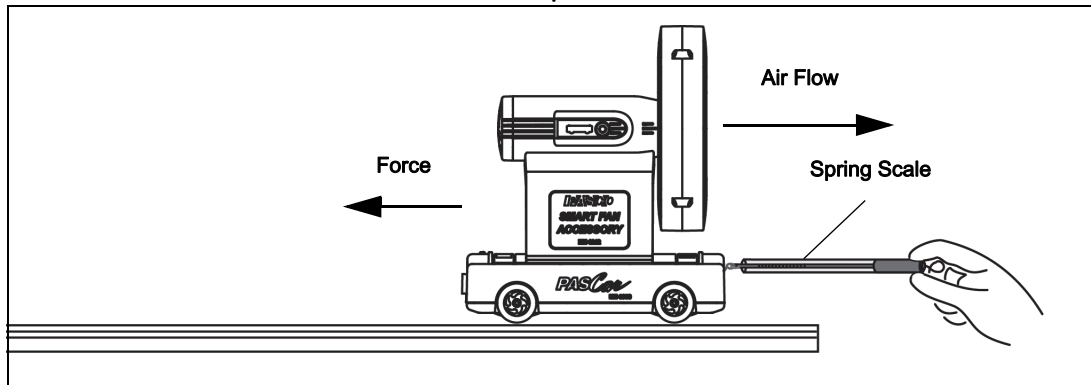


Note: To prevent the Smart Fan Accessory from coming off the cart during a collision with a wall or an End Stop, secure it to the cart with a rubber band as shown.

Experiment #2: Determine the force of the Smart Fan Accessory by connecting the cart to a mass that hangs over a pulley. Adjust the hanging mass until the cart doesn't move. Vary the fan speed and repeat.

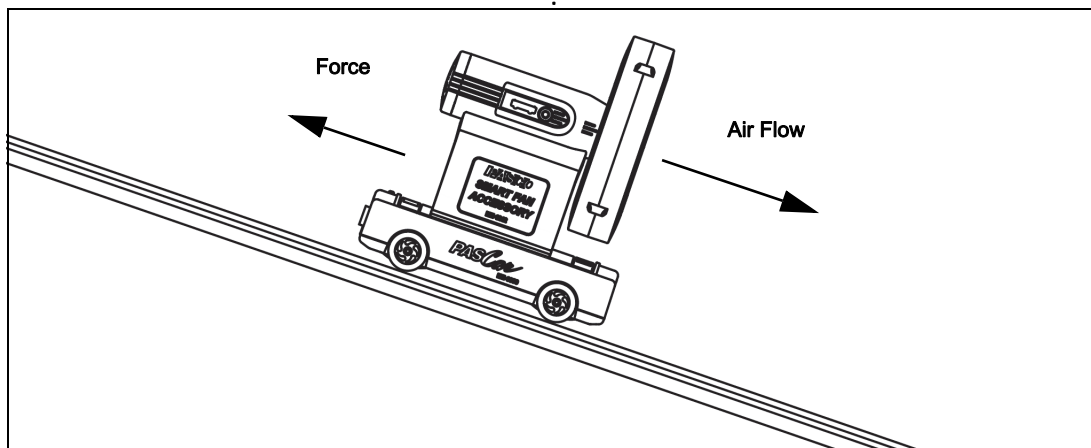


Alternative method: Use a spring scale to determine the Smart Fan Accessory's force at three different propeller speeds.



¹ For a discussion of fan cart experiments, refer to Robert A. Morse, "Constant Acceleration Experiments with a Fan-Driven Dynamics Cart," *The Physics Teacher*, October, 1993, pp. 436-438.

Experiment #3: Counteract the fan's force with the force of gravity by inclining the track until the cart with the Smart Fan Accessory cannot climb it. Vary the fan speed and repeat.



Specifications

Mass of Smart Fan Accessory (with four AA Energizer™ batteries) ¹	approximately 280 g
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¹Note: The masses of batteries of different brands vary slightly, so it is important to measure the mass of the Smart Fan Accessory yourself.

Technical Support

For assistance with any PASCO product, contact PASCO at:

Address: PASCO scientific
10101 Foothills Blvd.
Roseville, CA 95747-7100

Phone: +1 916-462-8384 (worldwide)
800-772-8700 ext 1004 (U.S)

Web: www.pasco.com

Email: support@pasco.com

Limited Warranty

For a description of the product warranty, see the PASCO catalog.

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Product End of Life Disposal Instructions:

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle/disposal service, or the place where you purchased the product.

The European Union WEEE (Waste Electronic and Electrical Equipment) symbol (to the right) and on the product or its packaging indicates that this product must not be disposed of in a standard waste container.



Battery Disposal Instructions:

Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where you can drop off your waste battery for recycling, please contact your local waste disposal service, or the product representative.