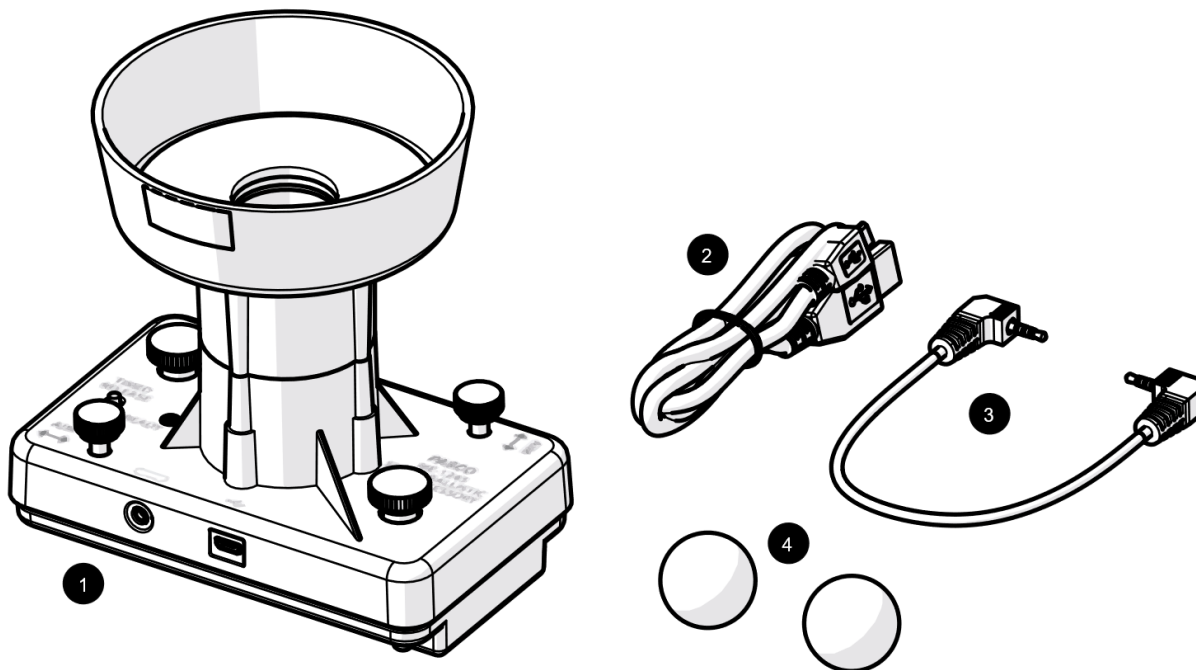


## Smart Ballistic Cart Accessory

ME-1245



### Included Equipment

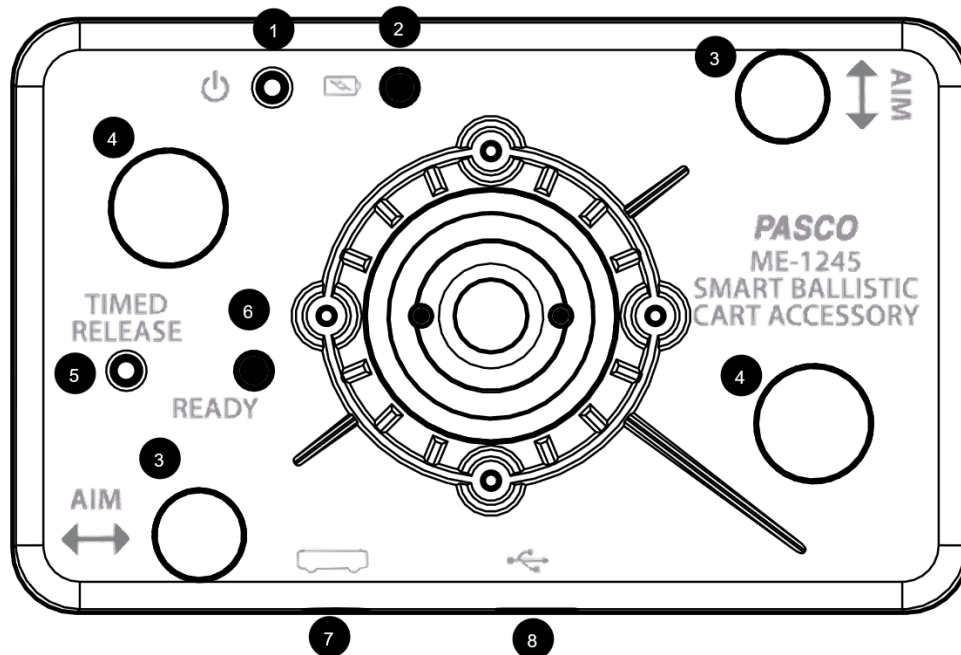
- 1 Smart Ballistic Cart Accessory**
- 2 Micro USB cable**  
For connecting the accessory to a USB charger.
- 3 Smart Cart Accessory Cable**  
For connecting the accessory to a Smart Cart.
- 4 Plastic Ball (2)**  
For use as a projectile. A spare is included.

### Required Equipment

The following table lists the equipment required to perform experiments with the Smart Ballistic Cart Accessory. Only one of the options provided for each item is required.

Item	Options	Item	Options
Cart	ME-1240 Smart Cart (Red)* ME-1241 Smart Cart (Blue)* ME-9454 Collision Cart ME-9430 Plunger Cart ME-6934 PAScar Blue ME-6933 PAScar Red ME-6951 GOcar	Track	ME-9493 1.2 m Aluminum Track ME-9779 2.2 m Aluminum Track ME-6960 PAStrack
		Software*	PASCO Capstone SPARKvue

\*A Smart Cart and software are only required if controlling the accessory remotely.



## Components

- |  |  |
|--|--|
| <p><b>1 Power button</b><br/>Press and hold to turn the power on or off.</p> <p><b>2 Battery status LED</b><br/>Red blink Battery needs to be recharged soon.<br/>Green solid Battery is fully charged.<br/>Yellow solid Battery is charging.</p> <p><b>3 Aim adjustment knob (2)</b><br/>Turn the knob to adjust the aim of the projectile.</p> <p><b>4 Mounting thumbscrew (2)</b><br/>For mounting the accessory to a cart.</p> | <p><b>5 Timed release button</b><br/>Press and hold to launch the projectile.</p> <p><b>6 Ready status LED</b><br/>Yellow blink Ready to launch.<br/>Yellow solid Launch mechanism is recharging.</p> <p><b>7 Smart Cart port</b><br/>For connecting the accessory to a Smart Cart.</p> <p><b>8 Micro USB port</b><br/>For connecting the included USB cable to a charger to charge the battery.</p> |
|--|--|

### WARNING

Wear safety glasses. Do not look down the barrel.

## Getting Started

Before using the device with students for the first time, perform the following tasks:

1. Charge the battery.

If using the accessory with a Smart Cart:

2. Update your PASCO data collection software.
3. Update the firmware of your Smart Cart.

## To charge the battery

1. Connect the USB cable to the USB port on the Smart Ballistic Cart Accessory. Connect the other end of the cable to a USB charger or port.
2. Allow the battery to charge for at least three hours. The battery status LED will turn green when fully charged.

Charging automatically stops when the battery is fully charged. The device can remain connected to a power source when fully charged without damaging the battery.

## To update PASCO data collection software


1. Open the PASCO data collection software.
2. The software will display a message if an update is available. Follow the instructions on the screen. If you do not receive a message, the software is up to date.

You can also check for an update by doing the following:



Go to the **Help** menu then click **Check for Updates**.



Select the menu icon  and select **Check for Updates**.

## To update the Smart Cart firmware

The Smart Cart contains firmware that controls how the device functions and works with accessories. It is important to make sure that your Smart Cart has the latest version of the firmware installed.

1. Connect the Smart Cart to your software. It is recommended to use a USB connection since this will result in a faster update.
2. The software will display a message if a firmware update is available. Follow the instructions on the screen. If you do not receive a message, the firmware is up to date.

## Using the Equipment

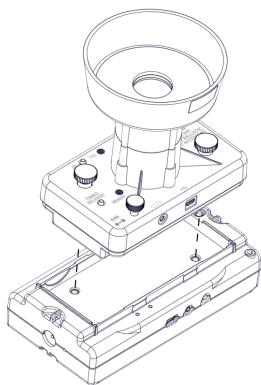


Figure 1. Placing the Smart Ballistic Cart in a Smart Cart.

## Mounting to a cart

1. Place the Smart Ballistic Cart Accessory in the accessory tray of the cart. For a Smart Cart, make sure that the ports on the accessory are on the same side as the ports on the cart (Figure 1).

2. Turn each mounting thumbscrew until finger-tight to secure the accessory to the cart.



## Launching a projectile remotely



1. Connect the Smart Cart to Capstone.
2. Connect the Smart Ballistic Cart Accessory to the Smart Cart using the Smart Cart accessory cable (Figure 2).
3. Under the Tools palette, click the Ballistic Cart tool.
4. Place the ball in the barrel and push down until it locks in place.
5. Launch the projectile by pressing the Trigger Now button in the Ballistic Cart panel.

The accessory can also be triggered by setting distance or time based conditions in the Ballistic Cart panel. These conditions will only trigger the cart while recording or monitoring data.



1. Connect the Smart Cart to SPARKvue.
2. Connect the Smart Ballistic Cart Accessory to the Smart Cart using the Smart Cart accessory cable (Figure 2).
3. Select  to build a new page.
4. Select the full screen template.
5. Select the Ballistic Cart tool .
6. Place the ball in the barrel and push down until it locks in place.
7. Launch the projectile by pressing the Trigger Now button in the Ballistic Cart panel.

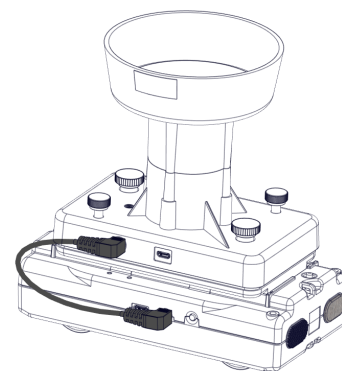


Figure 2. Smart Ballistic Cart Accessory connected to a Smart Cart.

## Launching a projectile manually

1. Press and hold the power button until the battery status LED turns on.
2. Place a ball in the barrel and push down until it locks in place.
3. Press the TIMED RELEASE button. The ball will launch after one second.

## Adjusting the Aim

The projectile should land back in the cup of the Smart Ballistic Cart Accessory after being launched. If the projectile consistently misses the cup, perform the following adjustments:

- Level the track.
- Turn the aim adjustment knobs to adjust the direction the projectile is launched. One knob tilts the barrel parallel to the track and the other tilts the barrel perpendicular to the track.

## Experiments

Copy-ready experiment worksheets for classroom use are available on the PASCO website. Download the experiments for free at:

[www.pasco.com/resources/lab-experiments](http://www.pasco.com/resources/lab-experiments)

## Replacement Parts

Replacement parts can be purchased from the PASCO website. Contact Technical Support if the part you need is not listed.

- ME-6822 Plastic Balls (10 Pack)
- PS-3584 Micro USB Cable

## Specifications

Property	Value
Timed release	1 s
Maximum launch height	>0.5 m

## Technical Support

For assistance with PASCO products, contact PASCO Technical Support at:

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

Phone: 916-462-8384

Web: [www.pasco.com](http://www.pasco.com)

Email: [support@pasco.com](mailto:support@pasco.com)

## FCC Statement

This digital device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## Product End of Life Disposal Instructions

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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.



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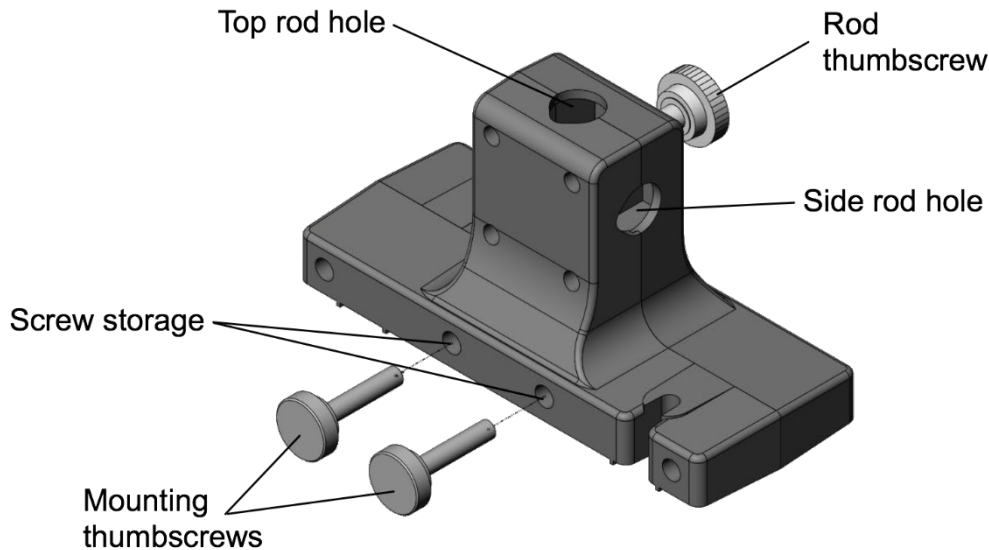
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## Smart Cart Rod Stand Adapter

ME-1244



### Introduction

The Smart Cart Rod Stand Adapter allows the PASCO Smart Cart to be suspended from a rod stand to measure forces with the Smart Cart force sensor. The adapter is precision made to fit securely in the accessory tray of Smart Cart models ME-1240 (red) or ME-1241 (blue). Built-in threaded screw storage holes provide a place to store the mounting thumbscrews when the adapter is not in use.

The Rod Stand Adapter accepts 3/8-inch (9.5 mm) to 1/2-inch (12.7 mm) rods. The Smart Cart can be mounted directly to a vertical rod to position the force sensor in a vertical direction. A second hole on the top of the Rod Stand Adapter allows the Smart Cart to be mounted to a horizontal cross-rod. When mounted to a horizontal rod, the force sensor can be placed further from the vertical rod and positioned at any angle.

Experiments performed with the Smart Cart Rod Stand Adapter determines how the adapter should be mounted. Mounting the Smart Cart vertically provides a stable setup for measuring the weight of a mass and the force of an oscillating mass on a spring. Mounting the Smart Cart on a horizontal rod is useful for statics experiments since forces can be measured at any angle.

### Operation

#### To install the adapter

1. Remove the mounting thumbscrews from the screw storage holes.
2. Place the adapter in the accessory tray of the Smart Cart (Figure 1).
3. Insert in the thumbscrews into each threaded hole of the Smart Cart and turn until finger-tight.

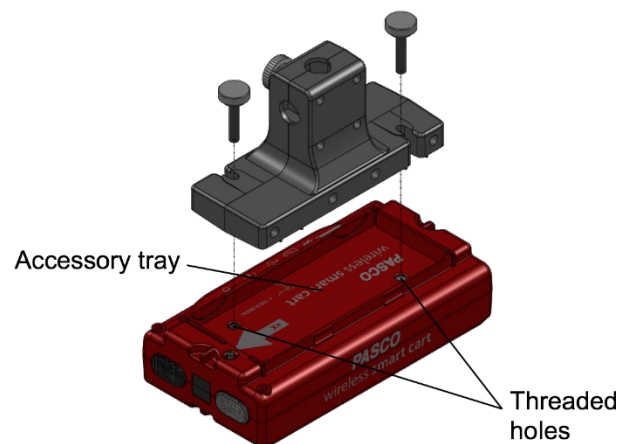


Figure 1. Place the adapter in the Smart Cart accessory tray.

### To mount to a vertical rod

1. Loosen the rod screw to allow a rod to be inserted into the rod holes.
2. Insert a rod into the side rod hole (Figure 2, left).
3. Tighten the rod screw until finger-tight.

### To mount to a horizontal rod

1. Set up two rods with a multi-clamp as shown in Figure 2 (right).
2. Loosen the rod screw to allow a rod to be inserted into the mounting hole.
3. Insert a rod into the top rod hole until the rod touches the bottom of the adapter.
4. Rotate the Smart Cart to the desired angle.
5. Tighten the rod screw until finger-tight.



**Figure 2.** The Smart Cart can be mounted directly to a vertical rod (left) or to a horizontal cross-rod (right).

## Technical Support

For assistance with PASCO products, contact PASCO at:

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10101 Foothills Blvd.  
Roseville, CA 95747-7100

Phone: 916-462-838

Web: [www.pasco.com](http://www.pasco.com)

Email: [support@pasco.com](mailto:support@pasco.com)

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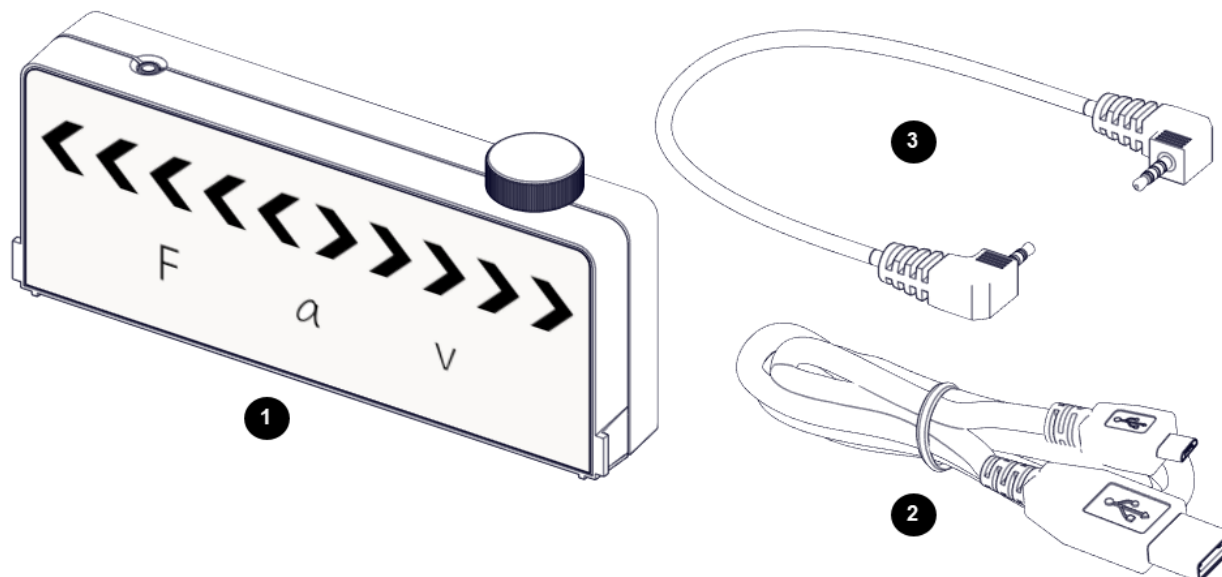
**Limited Warranty** For a description of the product warranty, see the PASCO catalog.

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## Smart Cart Vector Display

ME-1246



### Product Summary

The Smart Cart Vector Display adds visual vectors to a Smart Cart<sup>1</sup> for force, acceleration, and velocity. Arrows light up proportional to the sensor reading showing either positive or negative direction and magnitude.

### Included Equipment

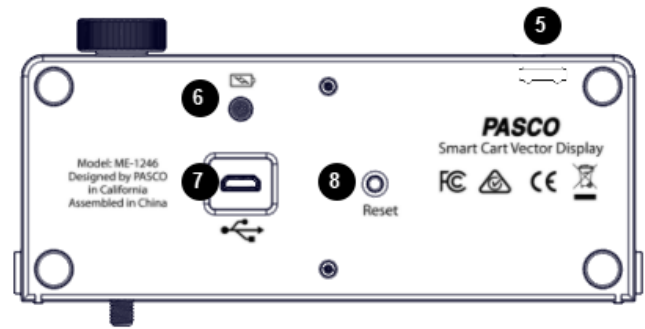
- 1 **Smart Cart Vector Display**
- 2 **Micro USB cable**  
For connecting the accessory to a USB charger.
- 3 **Smart Cart Accessory Cable**  
For connecting the accessory to a Smart Cart.

### Required Equipment

The following table lists the equipment required to perform experiments with the Smart Cart Vector Display. Only one of the options provided for each item is required.

Item	Options
Smart Cart	ME-1240 Smart Cart (Red) ME-1241 Smart Cart (Blue)
Software	PASCO Capstone SPARKvue

<sup>1</sup> U.S. Patent 10,481,173, issued 2019.



## Components

- 1 Thumbscrew**  
For securing the accessory to a Smart Cart.
- 2 Tab**  
For inserting into the slot of a Smart Cart.
- 3 Magnitude and Direction Indicator Lights**  
The illuminated arrows indicate the direction of the selected measurement. The number of illuminated arrows indicate the magnitude.
- 4 Measurement Indicator Lights**  
The illuminated variable indicates the displayed measurement.
- 5 Accessory Port**  
For connecting the accessory to a Smart Cart using the Smart Cart accessory cable.
- 6 Battery Indicator Light**  
Red blink      Low charge  
Green solid    Full charge  
Yellow solid   Charging
- 7 Micro USB port**  
For connecting the accessory to a USB charger using the USB cable.
- 8 Reset Button**  
Press and hold for one second if the accessory is malfunctioning.

## Getting Started

Before using the device with students for the first time, perform the following tasks:

1. Charge the battery.
2. Update your PASCO data collection software.
3. Update the firmware of your Smart Cart.

### Charge the battery

1. Connect the USB cable to the USB port on the accessory. Connect the other end of the cable to a USB charger or port.
2. Keep the device connected to the charger until the battery is fully charged.

**Tip:** The device can remain connected to the charger when the battery is fully charged.

### Update PASCO data collection software

1. Open the PASCO data collection software.
2. The software will display a message if an update is available. Follow the instructions on the screen. If you do not receive a message, the latest version of the software is installed.

### Update the Smart Cart firmware

The Smart Cart contains firmware that controls how the device functions and connects with accessories. The cart and accessories may not function correctly if the latest firmware is not installed.

1. Connect the Smart Cart to your software.

**Tip:** Use a USB connection for a faster update.

2. The software will display a message if a firmware update is available. Follow the instructions on the screen. If you do not receive a message, the firmware is up to date.



## Using the Equipment

### Connect the Vector Display to a Smart Cart

The Smart Cart Vector Display is required to be connected to a Smart Cart. The display can be put in the Smart Cart accessory tray upright to view from the side or flat to view from overhead.

1. Connect the Smart Cart accessory cable to the accessory port on the Vector Display. Connect the other end of the cable to the accessory port on the Smart Cart.
2. Put the display on the cart in an upright or flat position, as shown in Figure 1:

**Tip:** When the  $v$  on the Vector Display is on the front side of the cart (force sensor side) the positive direction of the cart matches the default positive direction of the display.

- Upright: Put the tabs on the Vector Display into the slots of the cart. Tighten the thumbscrew to hold the display in place.
  - Flat: Put the display flat in the Smart Cart accessory tray with the display facing up.
3. Press and hold the Smart Cart power button to power on the cart and Vector Display.

The Vector Display is configured to display the Smart Cart's accelerometer measurement at the  $5 \text{ m/s}^2$  range by default.

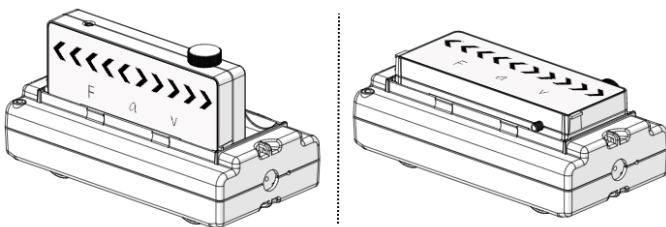


Figure 1. The Vector Display put in a Smart Cart in an upright (left) and flat (right) position.


### Change the displayed measurement

Use PASCO Capstone or SPARKvue to select a Smart Cart measurement to display. Use the software to also adjust the range and sign of the measurement.

Before performing these steps, be sure that:

- The Smart Cart is connected to the software.
- The accessory is connected to the Smart Cart.





1. In the Tools palette, go to the Vector Display tool .
2. Go to the Measurement menu then select a measurement to display.
3. Go to the Range menu then select a range to display.

**Tip:** The range corresponds to the magnitude displayed when all five arrows are illuminated on the display. For example, if the range is set to  $0.5 \text{ m/s}$ , each arrow equates to  $0.1 \text{ m/s}$ .

4. (Optional) Select the Check Sign checkbox to change the positive direction of the measurement.



1. Select  to build a new page.
2. Select the full screen layout.
3. Select the Vector Display tool .
4. Go to the Choose Device menu then select the Vector Display to configure.
5. Go to the Measurement menu then select a measurement to display.
6. Go to the Range menu then select a range to display.

**Tip:** The range corresponds to the magnitude displayed when all five arrows are illuminated on the display. For example, if the range is set to  $0.5 \text{ m/s}$ , each arrow equates to  $0.1 \text{ m/s}$ .

7. (Optional) Change the Change Sign switch to On to change the positive direction of the measurement.

## Experiments

Copy-ready experiment worksheets for classroom use are available on the PASCO website. Download the experiments for free at:

[www.pasco.com/resources/lab-experiments](http://www.pasco.com/resources/lab-experiments)

## Technical Support

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## FCC Statement

This digital device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 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.

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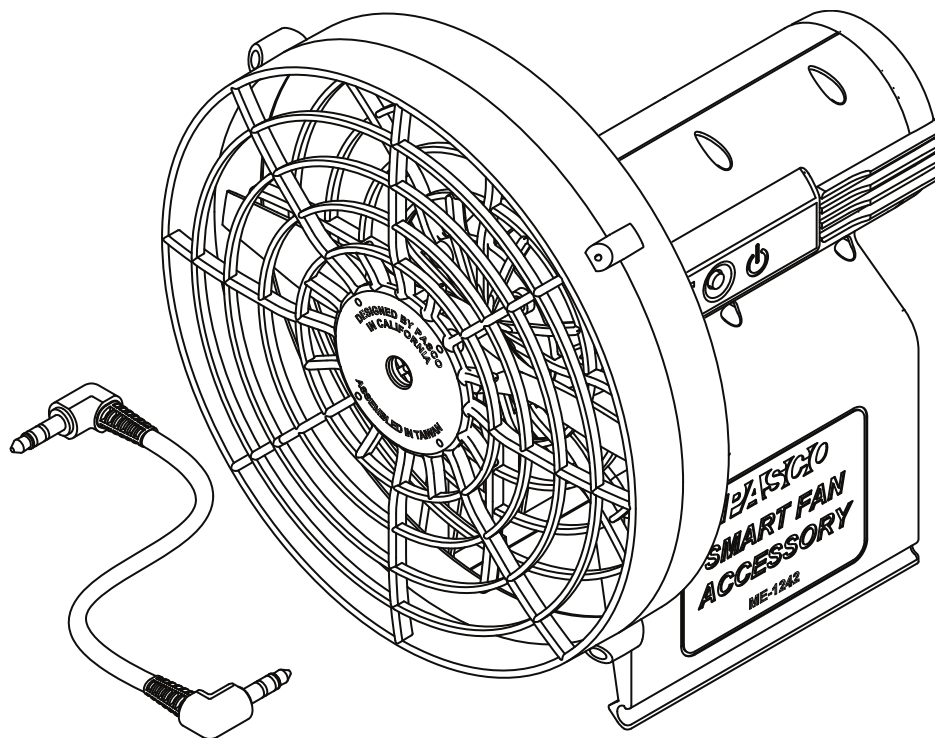
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# Smart Fan Accessory

ME-1242



## About the Product

The Smart Fan Accessory mounts on any PASCO cart for use with or without a track. The fan accelerates the cart by applying a constant force on the cart. The force can be adjusted by changing the fan thrust using the power button. The fan speed can also be controlled with PASCO data collection software when used with a Wireless Smart Cart.

## What's Included

- Smart Fan Accessory
- Smart Cart Accessory Cable
- Battery, AA-Cell (4)

## Required Items

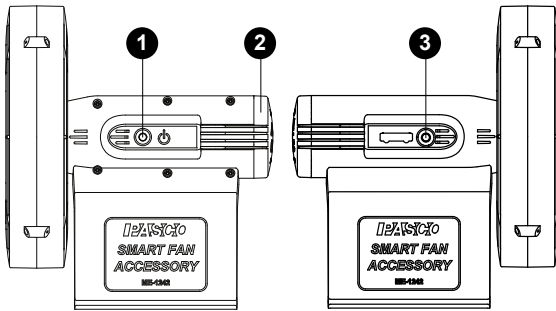
### Manual Mode

- PASCO Cart  
The fan can be attached to any PASCO cart.

### Software Mode

- Wireless Smart Cart  
Either the red (ME-1240) or blue (ME-1241) Wireless Smart Cart is required to connect the fan with PASCO software.
- PASCO Data Collection Software  
PASCO Capstone or SPARKvue can be used to control the fan.

## Components



### 1 Power Button

Press to turn on the fan. Press again to change the fan speed. Press and hold to turn off the fan.

### 2 Battery Cover

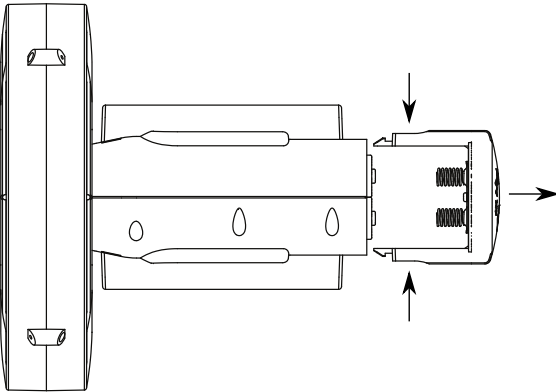
Press the sides of the cover and pull away from the accessory to access the battery compartment.

### 3 Smart Cart Port

Use with the Smart Cart accessory cable to connect the fan to a Smart Cart.

## Install the batteries

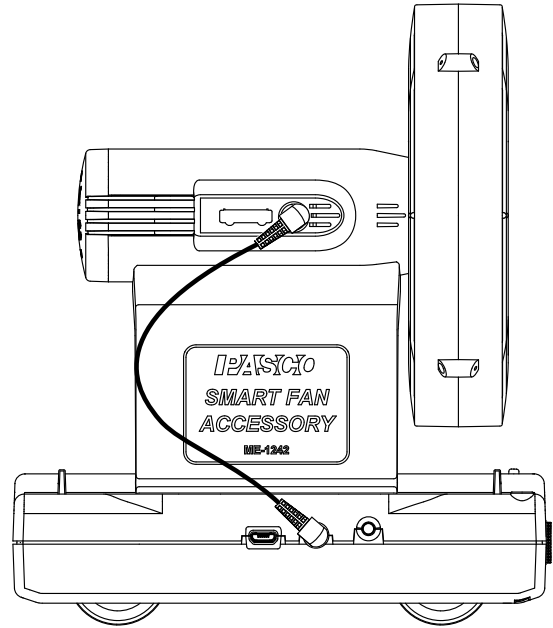
The Smart Fan Accessory requires four AA batteries. Use either alkaline (included) or rechargeable batteries.



1. Remove the battery cover from the end of the Smart Fan Accessory. Press the sides of the cover and pull away from the accessory.
2. Insert four AA batteries into the battery compartment. Insert the positive (+) end of the battery into the section that does not have a spring.
3. Place the battery cover back on the accessory and press until it clicks into place. Make sure that the springs on the cover are aligned with the negative ends of the batteries.

## Attach to a cart

The Smart Fan Accessory attaches to the rails of the cart accessory tray.



1. Position the fan over the cart so that the fan points toward the rear of the cart.
2. Place the fan over the rails of the cart accessory tray. Press down until the fan snaps into place.
3. If using a Smart Cart, connect the Smart Cart Accessory Cable to the ports on the fan and the cart.

## Control the fan thrust (manual mode)

Set the fan thrust at three different levels using the power button.

1. Press the power button to turn on the fan.
2. Press the power button again to change the fan thrust. Three different thrust levels are available.
3. Press and hold the power button to turn off the fan.



## Control the fan thrust (software mode)

### Access the Smart Fan control panel

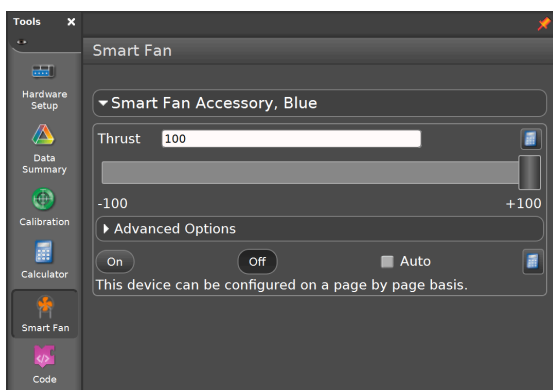
Use the Smart Fan control panel to set the fan thrust magnitude and direction.

#### SPARKvue



1. Connect the Smart Cart to SPARKvue.
2. Click  to build a new experiment page.
3. Select any layout.
4. Select the Smart Fan display .

#### PASCO Capstone



1. Connect the Smart Cart to Capstone.
2. Select **Smart Fan**  in the Tools palette.

### Control the fan manually

Set the fan's thrust magnitude and direction using manual software controls.

#### Turn the fan on or off

Click the **On** or **Off** buttons to manually turn the fan on or off.

Alternatively, set the fan to turn on automatically while collecting data:






1. Select the **Auto** checkbox.
2. Start data collection to turn on the fan.
3. Stop data collection to turn off the fan.


#### Set the thrust magnitude and direction

The thrust can be set at a value between -100 and +100. Setting the thrust to a negative value will reverse the thrust to apply a force in the opposite direction. To set the thrust, enter a value in the text box or drag the slider.

### Create a program

Use the **Code** tool to control the Smart Fan by building a program using Blockly.

1.  **SPARKvue** Click  on the Experiment Screen.
  -  **PASCO Capstone** Select **Code**  on the Tools palette.
2. Drag one of the Smart Fan blocks from the **Hardware** group to the workspace:
  - **On/Off Block** 



Use this block to turn the fan on when its parameter is set to `true` and off when set to `false`. A **Logic** block can be used in place of the true/false block to create a logical expression to turn the fan on or off.
  - **Thrust Block** 

Use this block to set the thrust of the Smart Fan between -100 and +100. You can set the thrust using the default number block or replacing it with a block from the **Math** group.
3. Add additional blocks from the Blockly toolbox to build a program to control the fan.

### Create a calculation

Create an equation to control the Smart Fan Accessory using a sensor measurement.

#### PASCO Capstone

1. In the **Smart Fan** panel, click .
2. Select **Create Calculation**.
3. Enter an equation to control the fan. Press  to enter a sensor measurement.

To exit calculation mode, click  then deselect **Use Calculation**.

### Set a start or stop condition

Set a measurement or time based condition to turn on (start) or turn off (stop) the fan.

#### PASCO Capstone

#### Measurement Based

Use this condition to start or stop the fan based on the value of a sensor measurement.

1. Click **Advanced Options**.
2. Click a condition menu then select **Measurement Based**.
3. Click the **Data Source** menu then select a **Measurement**.
4. Click the **Condition** menu then select the type of condition. The type of condition is based on the number entered under **Value**.
5. Under **Value**, enter the conditional value.

#### Time Based

Use this condition to start or stop the fan based on the time elapsed after starting data collection.

1. Click **Advanced Options**.
2. Click a condition menu then select **Time Based**.
3. Enter a value under **Duration**.

## Additional Resources

### Software Help

Additional information on how to use the Smart Fan Accessory with SPARKvue and Capstone can be found in the SPARKvue and PASCO Capstone Help. The help can be accessed within the software or online.

#### SPARKvue

Software: Click  then select **Help**.

Online: [pasco.com/help/sparkvue](https://www.pasco.com/help/sparkvue)

#### PASCO Capstone

Software: In the menu bar, click **Help** then select **PASCO Capstone Help**.

Online: [pasco.com/help/capstone](https://www.pasco.com/help/capstone)

### Product Information

Visit the product web page at [pasco.com/product/ME-1242](https://www.pasco.com/product/ME-1242) for additional information including:

- Specifications
- Buying Guide
- Experiments
- Documents



### Technical Support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to provide assistance with this or any other PASCO product.

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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 or disposal service, or the place where you purchased the product.

The European Union WEEE (Waste Electronic and Electrical Equipment) symbol 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. The battery used in this product is marked with the International symbols to indicate the need for the separate collection and recycling of batteries.

### FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### CE Statement

This device has been tested and found to comply with the essential requirements and other relevant provisions of the applicable EU Directives.

### Patents

The Smart Cart (ME-1240 and ME-1241) is covered by U.S. Patent No. 10,481,173.

The Smart Fan Accessory is covered by U.S. Patent No. 10,482,789.

# Wireless Smart Cart [ME-1240 (Red) / ME-1241 (Blue)]

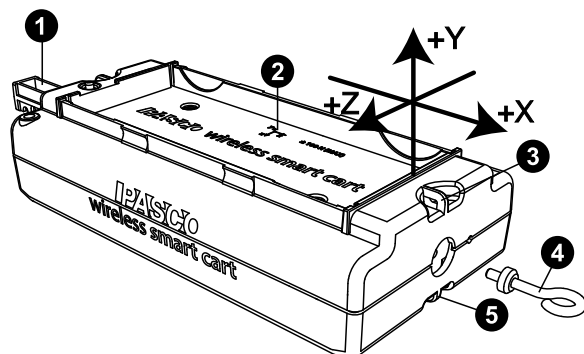
## Introduction

The Wireless Smart Cart is a combination wireless *and* USB device that connects to a computer or tablet through Bluetooth, or to a computer or USB charger through an included micro USB cable. The Smart Cart has a durable ABS body, a three-position plunger, and nearly frictionless wheels. It includes built-in sensors which measure acceleration in three dimensions, position, velocity, and force. The Smart Cart also includes a gyroscope-type sensing element which can measure rotational motion. The Smart Cart can make its measurements on or off a dynamics track and transmit them wirelessly. For easy identification, the Smart Cart is available in red or blue.

The accessory tray on the top of the Smart Cart can hold any accessory designed for a PASCO cart except the Spring Cart Launcher (ME-6843). The Smart Cart has the same dimensions as other PASCO carts and can be used with any PASCO track. The Smart Cart can be stacked with any PASCO cart and has a mass of approximately 0.250 kilograms (250 grams). It has attachment points on the top and bottom of both ends, as well as Velcro® tabs for inelastic collisions on one end. The magnetic bumper, bumper attachment, and hook attachment fit into the threaded hole in the end of the Smart Cart opposite to the tabs.

The built-in sensors measure force in the range between -100 newtons (N) and +100 N, acceleration in the range between -16 g and +16 g (where  $g = \pm 9.8 \text{ m/s}^2$ ), and angular rotation rate up to  $\pm 145$  degrees per second (dps). The cart measures force as a push or pull along its x-axis and measures acceleration in three dimensions (x, y, and z). PASCO Capstone or SPARKvue can also show the resultant acceleration. The encoder wheels on the Smart Cart measure velocity to a maximum of 3.0 meters per second; the wheels have a position resolution of 0.2 mm. The positive direction of motion is the same as the x-axis in the printed graphic representing the acceleration sensor's position.

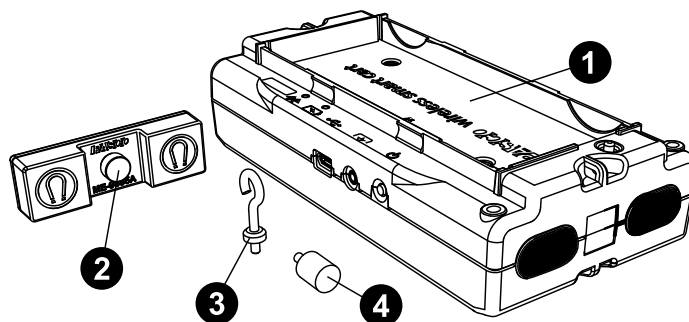
The Smart Cart is designed to optimize battery usage time and will turn off after about five minutes if not connected to the software. Since each Smart Cart has a unique device ID number, more than one can be connected to a computer or tablet at once.



- 1 Three-position plunger
- 2 Acceleration and gyro sensor position
- 3 Attachment point
- 4 Hook attachment
- 5 Attachment point

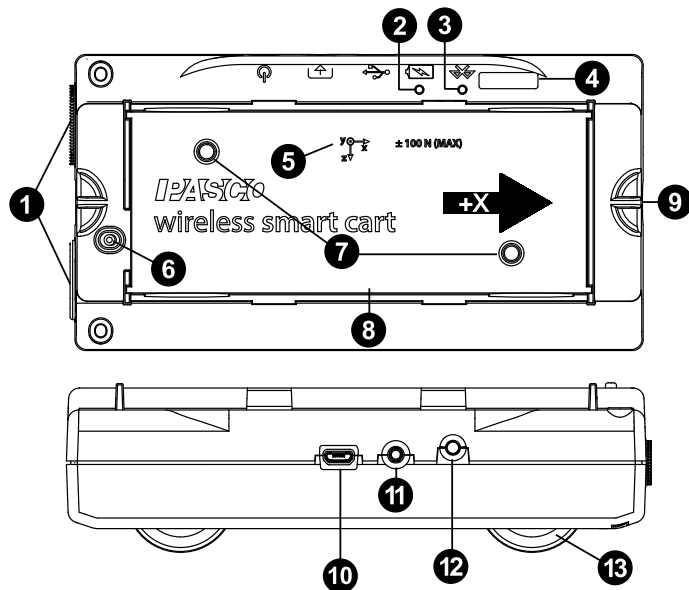
## Equipment

Included equipment:



- 1 Wireless Smart Cart (ME-1240 or ME-1241)
- 2 Magnetic bumper
- 3 Bumper attachment
- 4 Hook attachment
- 5 Micro USB cable (not pictured)

Features:



- 1 Velcro® tab  
Allows two carts to attach to each other in an inelastic collision.
- 2 Battery Status LED  
Indicates the charge level and status of the cart's battery.

Battery LED	Status
Red blink	Low power
Yellow ON	Charging
Green ON	Fully charged

**3 Bluetooth Status LED**

Indicates the status of the cart's Bluetooth connection.

Bluetooth LED	Status
Red blink	Ready to pair
Green blink	Connected



**NOTE:** The Bluetooth LED will not light up if the sensor is connected to the software via micro USB cable.

**4 Device ID**

Use this to identify the cart when connecting via Bluetooth.

**5 Accelerometer position**

Indicates the position of the acceleration and gyro sensor within the cart, as well as the direction of the three dimensions of acceleration (the x-axis, y-axis, and z-axis).

**6 Plunger release**

Press to immediately release the plunger to its maximum extension.

**7 Threaded holes (M5)**

Use to secure accessories in place on top of the cart.

**8 Accessory tray**

Use to hold accessories mounted on the cart.

**9 Attachment point**

Use these points to tie a string to the cart for various experiments.

**10 Micro USB port**

Use with the included micro USB cable to connect the cart to a USB charger. The port and cable can also be used to directly connect the cart to a computer without the use of Bluetooth. This connection method is not supported by iOS.

**11 Accessory port**

Use to connect various accessories to the Smart Cart, enable data collection from them, and control them.

**12 ON/OFF button**

Press to turn the cart on. Press and briefly hold to turn the cart off.

**13 Built-in wheel encoder**

Used to automatically record position, velocity, and acceleration of the wheels during data collection.

**Required equipment:**

- Data collection software (PASCO Capstone or SPARKvue)

**Initial step: Charge the battery**

Charge the battery by connecting the USB port to any standard USB charger. The Smart Cart Charging Garage (ME-1243) allows up to five Smart Carts to be charged simultaneously, while also serving as a storage option for the cart and bumpers. The battery status light is solid yellow while charging. When fully charged, the light changes to solid green.

**Get the software**

You can use the Smart Cart with SPARKvue or PASCO Capstone software. If you're not sure which to use, visit [pasco.com/products/guides/software-comparison](https://www.pasco.com/products/guides/software-comparison).

SPARKvue is available as a free app for Chromebook, iOS, and Android devices. We offer a free trial of SPARKvue and Capstone for Windows and Mac. To get the software, go to [pasco.com/downloads](https://www.pasco.com/downloads) or search for **SPARKvue** in your device's app store.

If you have installed the software previously, check that you have the latest update:

**SPARKvue**

Go to Main Menu  > **Check for Updates**

**PASCO Capstone**

Go to **Help** > **Check for Updates**.

The Wireless Smart Cart can also be used with the free PASCO program MatchGraph!, which can be downloaded at [pasco.com/matchgraph](https://www.pasco.com/matchgraph).

**Check for a firmware update****SPARKvue**

- Press the power button until the lights turn on.
- Open SPARKvue.
- Select **Sensor Data** on the Welcome Screen.



- Select the sensor that matches your sensor's device ID. A notification appears if a firmware update is available. Click **Yes** to update the firmware.
- Close SPARKvue.

**PASCO Capstone**

- Press and hold the power button until the lights turn on.
- Open PASCO Capstone.
- Click **Hardware Setup**.



- Select the sensor that matches your sensor's device ID. A notification appears if a firmware update is available. Click **Yes** to update the firmware.
- Close Capstone.



## Setting up the software

Collecting data from the Smart Cart requires PASCO Capstone, SPARKvue, or MatchGraph! software. The Smart Cart can be connected to any of these programs using either Bluetooth or a USB connection.

### SPARKvue

#### To connect to SPARKvue using Bluetooth:


1. Turn on the Smart Cart. Check to make sure that the Bluetooth LED is blinking red.
2. Start SPARKvue, then select **Sensor Data** from the main menu.
3. From the list of available wireless devices, select the Smart Cart which matches the device ID (XXX-XXX) printed on your Smart Cart to connect to the cart.

#### To connect to SPARKvue using the micro USB cable:

1. Turn on the Smart Cart.
2. Start SPARKvue, then select **Sensor Data** from the main menu.
3. Connect the micro USB cable (included) from the micro USB port on the Smart Cart to a USB port on the computer, or into a powered USB hub connected to the computer. The cart will connect automatically.


Upon connecting to the Smart Cart, a list of available Smart Cart sensor measurements will automatically appear in the **Select Measurements for Templates** section.

#### To collect data with SPARKvue:


1. From the **Sensor Data** menu, after connecting to the Smart Cart, enable the desired measurements by clicking the checkboxes next to those measurements.
2. In the **Templates** section, select **Graph** to enter the Experiment Screen.
3. The Graph template will automatically populate the axes with the measurements you selected on the y-axis (or y-axes if you selected multiple measurements) and time on the x-axis. To change the quantity measured on an axis, click the buttons displaying the current measurement, then select the appropriate quantity from the list.
4. When you are ready, click **Start**  to begin collecting data.


### PASCO Capstone

#### To connect to Capstone using Bluetooth:


1. Turn on the Smart Cart.
2. Start Capstone, then select **Hardware Setup**  from the **Tools** palette.
3. From the list of **Available Wireless Devices**, select the Smart Cart which matches the device ID (XXX-XXX) printed on your Smart Cart to connect to the cart.

#### To connect to Capstone using the micro USB cable:

1. Turn on the Smart Cart.
2. Start Capstone. If desired, select **Hardware Setup**  from the **Tools** palette to verify the connection status.
3. Connect the micro USB cable (included) from the micro USB port on the Smart Cart to a USB port on the computer, or into a powered USB hub connected to the computer. The cart will connect automatically.

When connecting the Smart Cart to Capstone, the measurement of all sensors will be enabled by default. Any undesired measurements can be disabled through the **Data Summary**  menu in the **Tools** palette.

#### To collect data from Capstone:

1. Double-click the **Graph** icon in the **Displays** palette to create a new Graph display.
2. On each axis, click **<Select Measurement>**, then choose the appropriate sensor measurement for your experiment from the list.
3. When you are ready, click **Record**  to begin recording data.

### MatchGraph!

#### To connect to MatchGraph! using Bluetooth:



1. Turn on the Smart Cart. Check to make sure that the Bluetooth LED is blinking red.
2. Start MatchGraph!. The **Sensor Not Found** window will open automatically.
3. Select **Choose Wireless Interface** from the bottom right corner of the **Sensor Not Found** window.
4. From the **Select Wireless Interface** list, select the Smart Cart which matches the device ID (XXX-XXX) printed on your Smart Cart to connect to the cart.

#### To connect to MatchGraph! using the micro USB cable:

1. Turn on the Smart Cart.
2. Connect the micro USB cable (included) from the micro USB port on the Smart Cart to a USB port on the computer, or into a powered USB hub connected to the computer.
3. Start MatchGraph!. The cart will connect automatically.

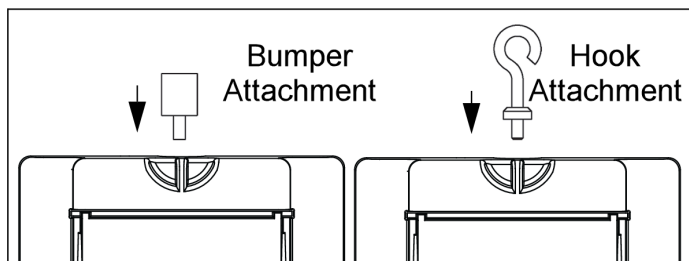
Note that MatchGraph! is only capable of tracking position and velocity data from the Smart Cart. Data from the cart's other measurements will not be collected.

#### To collect data from MatchGraph!:

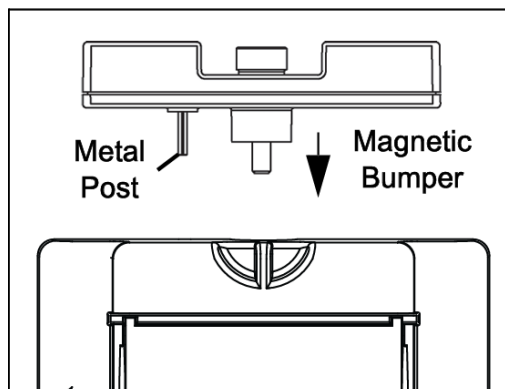
1. Select whether you want to track position or velocity data from the Smart Cart.
2. Choose a profile to be displayed by clicking **View All Profiles**  at the top of the screen and selecting a profile from the list.
3. When you are ready, click **Record**  to begin tracking data.

## Connecting bumper and hook attachments

Screw the bumper or hook attachment into the threaded hole on the front end of the Smart Cart, as shown below.



The magnetic bumper has a metal post that fits in the small hole to the side of the threaded hole on the front end of the Smart Cart, as shown below. The post ensures that the magnetic bumper is mounted in the correct orientation.



Screwing any of these attachments into the threaded hole on the front end of the Smart Cart connects them to the Smart Cart's built-in Force Sensor, allowing measurements of the force on the cart to be collected.



**IMPORTANT:** If using the Smart Cart for collisions, do NOT use the rubber bumper, as the force of impact on the bumper may damage the internal force sensor. Instead, any of the following components can be used as a bumper for collision experiments:

- Light Spring Bumper (ME-9275)
- Bumper Accessory Set (ME-9884)
- Magnetic Bumper Set (ME-9885A)

## Direction of acceleration

The acceleration sensing unit inside the Smart Cart is oriented so that the acceleration axes are aligned with the  $x$ - $y$ - $z$  arrows indicating the direction of positive acceleration.

In this orientation, the  $x$ -axis direction is 'along' the long axis of the Smart Cart; the  $y$ -axis direction is 'perpendicular' relative to the top of the Smart Cart; and the  $z$ -axis direction is 'perpendicular' to the long axis of the Smart Cart and parallel relative to the top of the cart.

## Zero (tare) the sensors

At the beginning of an experiment, the measurement from the built-in force and acceleration sensors may not be zero when the force or acceleration is actually zero. This is a normal behavior that is corrected when you zero (or *tare*) the sensor using PASCO Capstone or SPARKvue. For information on zeroing a sensor in these programs, see the Capstone or SPARKvue online help and search for "**Zero sensor**".

## Calibration

The Smart Cart is factory calibrated, so calibration is not necessary, especially if you are measuring a change in a measurement rather than absolute values. However, it is possible to calibrate the sensors if desired. For information on calibrating a Smart Cart, see the PASCO Capstone or SPARKvue online help.



**NOTE:** Zeroing of the acceleration sensor should **only** be performed if you are measuring acceleration on only a single axis, as zeroing the sensor will cause the measurements of acceleration on the other two axes to no longer report accurate values.

## Accessories

A number of accessories are available for the Wireless Smart Cart. Links to these products can be found on the product page. In particular, certain accessories are designed specifically to be used with the Wireless Smart Cart, including:

- Smart Fan Accessory (ME-1242)
- Smart Ballistic Cart Accessory (ME-1245)
- Smart Cart Vector Display (ME-1246)
- Smart Cart Motor (ME-1247)

For instructions on mounting these accessories to the Smart Cart, see the manual for the product in question.

## Troubleshooting

- If the Wireless Smart Cart loses Bluetooth connection and will not reconnect, try cycling the ON button. Press and briefly **hold** the button until the status LEDs blink in sequence, then release the button. Start the Smart Cart in the usual way.
- If the Smart Cart stops communicating with the computer software or tablet application, try restarting the software or application. If the problem remains, press and hold the ON button for 10 seconds, then release. Start the Smart Cart in the usual way.
- If the above problems do not solve the connection issue, turn Bluetooth off and back on for your computer, then retry.

## About the battery

The Smart Cart's battery is partially charged at the factory. If the battery status LED blinks red, use the micro USB cable to connect the sensor to a USB port or a USB charger.

## Maximizing battery life

One of the factors that affects battery life is the storage temperature. Therefore, avoid storing the Smart Cart in very cold or very hot environments.

## Battery troubleshooting

If the Smart Cart battery will not charge, it may need to be replaced. Contact Technical Support for information about battery replacement.

## Software help

The SPARKvue and PASCO Capstone Help provide additional information on how to use this product with the software. You can access the help within the software or online.

### SPARKvue

**Software:** Main Menu  > Help

**Online:** [help.pasco.com/sparkvue](http://help.pasco.com/sparkvue)

### PASCO Capstone

**Software:** Help > PASCO Capstone Help

**Online:** [help.pasco.com/capstone](http://help.pasco.com/capstone)

## Specifications and accessories

Visit the product page at [pasco.com/product/me-1240](http://pasco.com/product/me-1240) or [pasco.com/product/me-1241](http://pasco.com/product/me-1241) to view the specifications and explore accessories. You can also download experiment files and support documents from the product page.

## Experiment files

Download one of several student-ready activities from the PASCO Experiment Library. Experiments include editable student handouts and teacher notes. Visit [pasco.com/freelabs/me-1240](http://pasco.com/freelabs/me-1240) or [pasco.com/freelabs/me-1241](http://pasco.com/freelabs/me-1241).

## Technical support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to answer your questions or walk you through any issues.

-  Chat [pasco.com](http://pasco.com)
-  Phone 1-800-772-8700 x1004 (USA)  
+1 916 462 8384 (outside USA)
-  Email [support@pasco.com](mailto:support@pasco.com)

## Regulatory information

### Limited warranty

For a description of the product warranty, see the Warranty and Returns page at [www.pasco.com/legal](http://www.pasco.com/legal).

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