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Apr 2024

Smart Pulley Sensor

Product Number: ENSMP-A122

Overview

This Smart Pulley is comprised of a pulley and Photogate sensor. This sensor is used to measure the speed of the pulley. This is performed by measuring the tangent velocity of the pulley. This Smart Pulley can measure the entire range of 0 – 99 m/s.

The Smart Pulley is mainly used in experiments connected to physics and mechanics, in measuring the velocity and acceleration of moving objects and to learn Newton's laws of dynamics. The Smart Pulley can be connected to all einstein™ data loggers.

Typical experiments

Physics

- Investigating the motion of dynamic carts on a track
- Investigating Newton's Second Law
- Investigating the motion of an Atwood machine

How it works

The Photogate has a narrow, infrared beam and fast response time, which provides very accurate signals of timing. When the pulley blocks the infrared beam between the source and detector, the output of the Photogate increases, and the light-emitting diode (LED) on the photo gate lights up. When the beam is not blocked, the output drops and the LED is off.

The data logger measures the time between successive blockings of the infrared beam and calculates velocity and time allowing for measurements of velocity, distance, acceleration, angular acceleration and angular velocity.

Sensor specification

Range:	0 – 99 m/s
Accuracy:	0.05 m/s
Resolution (12-bit):	0.024 m/s
Max. Sampling Rate:	100 m/s
Timing Interval:	< 5µs
Parallax Error:	For an object passing within 1 cm of the detector, with a velocity less than 10 m/s, the difference between the true and effective length is less than 1 mm.
Infrared Source:	Peak at 800 nm
Data Logger Input Type:	Digital

Equipment List

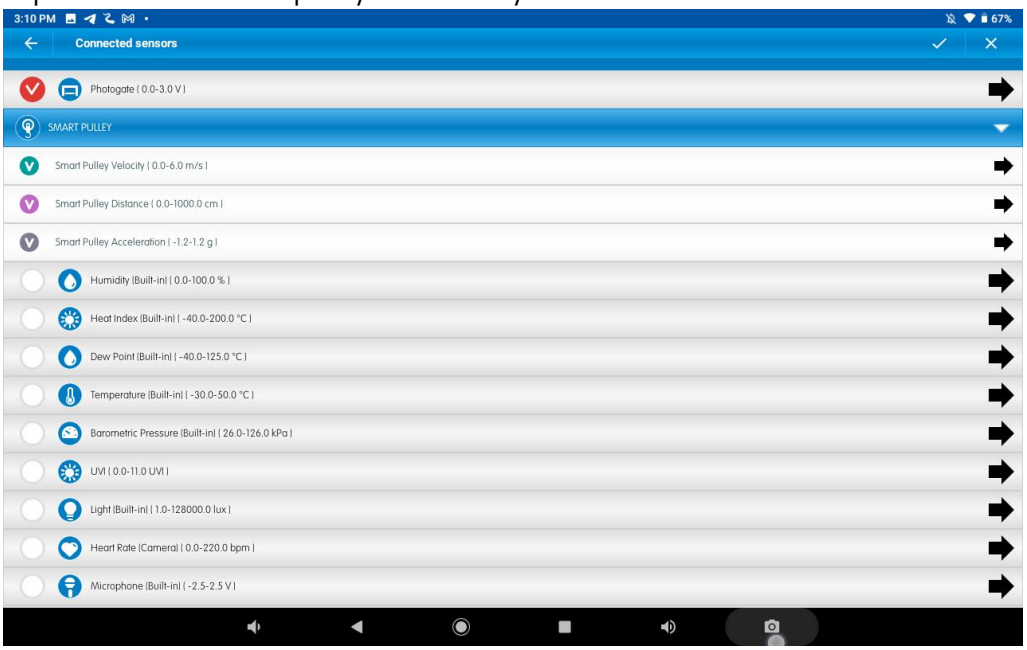
- Smart Pulley
- Photogate
- Mounting Rod

Data logging and analysis

Android

1. Take your einstein™ Tablet OR pair your einstein™ LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports

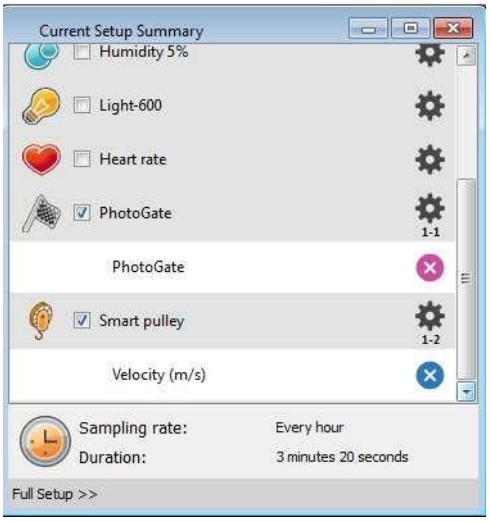
3. Launch MiLABEx and tap on LAB start an Experiment
4. MiLABEx will automatically detect the sensor
5. Tap on Sensors and keep only Smart Pulley and the selected measurement



6. Make sure the icon next to the sensor is checked enable it for logging
7. Tap V to save the settings.

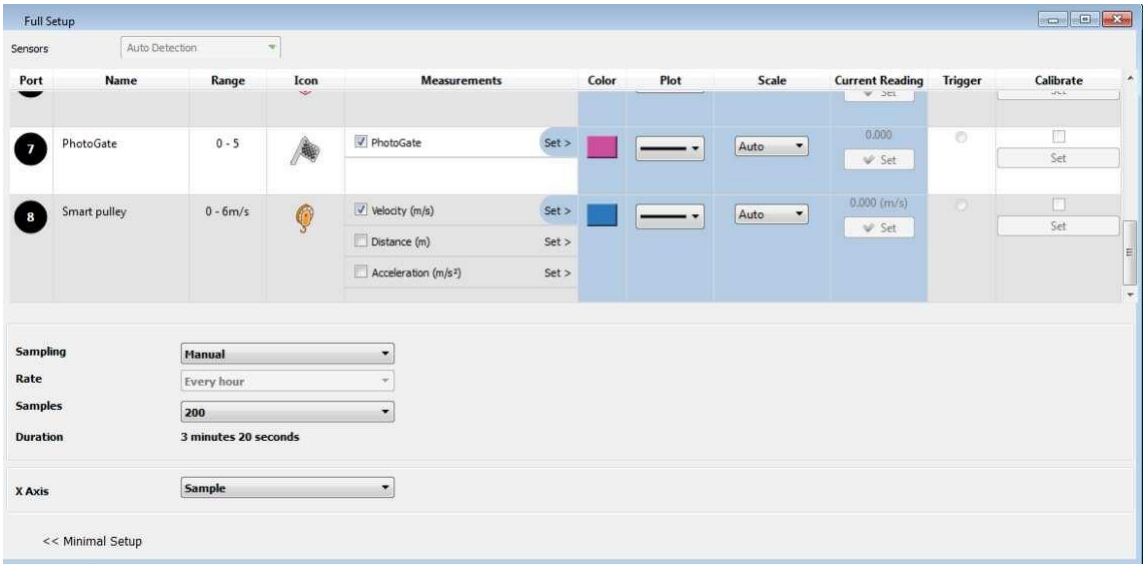
Desktop

1. Pair your einstein™LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable (found in the einstein™ LabMate box).
2. Insert the sensor cable into one of the sensor ports
3. MiLABEx will automatically detect the sensor
4. MiLAB will automatically detect the sensor and show it in the Current Setup Summary window



5. Select Smart Pulley and uncheck photogate.
6. Click Full Setup, located at the bottom of the current setup summary window to program the data logger's sample rate, number of samples, units of

measurement, and other options



7. Click the Run button on the main toolbar of the Launcher View to start logging

Calibration

The Smart Pulley sensor ships fully calibrated and no further calibration is needed.

The rod included with the Photogate can be threaded into the hole in the Photogate. It provides a convenient method to mount the photo gate. Place the rod through the hole in the Photogate and move the pulley into position so that the rod can be threaded into it. Tighten up the rod so that the pulley is held firmly against the photogate. When properly positioned, the spokes of the pulley will block the infrared beam of the photo gate, each time the spokes pass by. The rod can be mounted to a ring stand using standard laboratory clamps.

An Example of using the Smart Pulley Sensor

Newton's Second Law

In this experiment, we check the relationship between Force and Acceleration. The slope of the Velocity versus time graph is the acceleration. The velocity is measured with the aid of a Smart Pulley sensor.

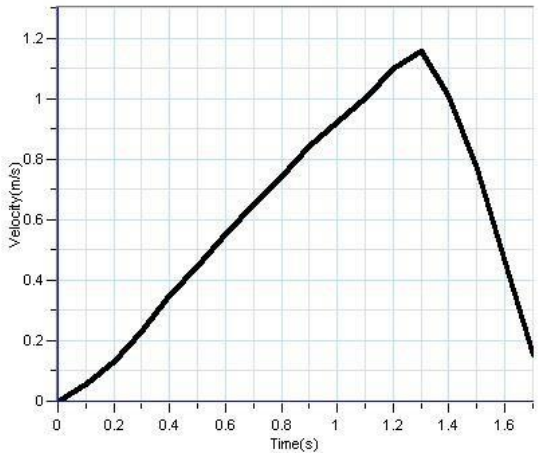


Figure 1: Velocity vs. time in an accelerate motion

Troubleshooting

If the Smart Pulley Sensor isn't automatically recognized by MiLAB, please contact Fourier Education's technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at: Web: www.einsteinworld.com/support

Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.

This warranty does not cover breakage of the product caused by misuse or abuse.

This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.