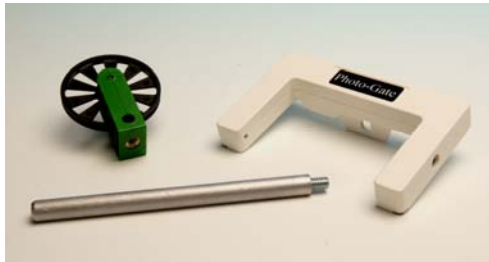


# Smart Pulley Sensor

# DT122A



The Smart Pulley can be connected to the Nova5000, MultiLogPRO or TriLink data loggers.

This Smart Pulley comprises a pulley and Photo Gate sensor. This sensor is used to measure the speed of a string suspended over the pulley. This is performed by measuring the tangent velocity of the pulley. This Smart Pulley is capable of measuring the entire range of 0 – 99 m/s.

The Smart Pulley is mainly used in Physics mechanics experiments, to measure velocity and acceleration of moving objects and to learn Newton's laws of dynamics.

## Typical Experiments

- Investigating dynamics carts motions on track
- Investigating the Newton's second law
- Investigating the motion of an Atwood's machine

## How it Works

The photo gate has a narrow, infrared beam and fast response time, which provides very accurate signals for timing. When the pulley blocks the infrared beam between the source and detector, the output of the photo gate is *high* (high voltage, 5 V, on the graph), and the light-emitting diode (LED) on the photo gate lights up. When the beam is not blocked, the output is *low* (low voltage, 0 V, on the graph), and the LED is off.

The data logger measures the time between successive blockings of the infrared beam and calculates the velocity.

## Sensor Specification

<b>Range:</b>	0 – 99 m/s
<b>Accuracy:</b>	0.05 m/s
<b>Resolution (12-bit):</b>	0.024 m/s
<b>Max. Sampling Rate:</b>	100 m/s
<b>Timing Interval:</b>	< 5 $\mu$ s
<b>Parallax Error:</b>	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.
<b>Infrared Source:</b>	Peak at 800 nm
<b>Data Logger Input Type:</b>	Digital

## Technical Notes

- The Smart Pulley sensor has to be connected only to the data logger's digital inputs, which are the first or the second input for the MultiLogPRO or TriLink and all of the Nova5000's inputs.
- The Smart Pulley sensor cannot be automatically identified by the data logger, so the data logger must be placed in *8-inputs* mode.

## Calibration

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

## Equipment List DT122A

Smart Pulley	DT122A
Smart Pulley attachment	DT122
Photo Gate	DT137

Smart Pulley DT122A



Smart Pulley attachment DT122



Photo Gate DT137





## Equipment Setup

The rod included with the photo gate can be threaded into the hole in the photo gate. It provides a convenient method to mount the photo gate. Place the rod through the hole in the photo gate 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 photo gate. 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.

## Using the Smart Pulley Sensor with the Nova5000 and MultiLab Software

By default, MultiLab displays the |Velocity measurement.

1. Launch the MultiLab CE software.
2. Connect the Smart Pulley sensor to the Nova5000's digital sensor input (starting from I/O-1).
3. Click **Setup** on the main toolbar
4. Uncheck the **Auto Detect Sensors** checkbox
5. Select **Smart Pulley** from the drop-down menu next to the Sensor input.
6. Program the data logger's sample rate and number of samples.
7. Click **Run** on the main toolbar to start the measurement.



## Using the Smart Pulley Sensor with the MultiLogPRO or TriLink and MultiLab Software

By default, Multilab Software displays the velocity measurement.

1. Set the MultiLogPRO or TriLink to *8-inputs* mode.
2. Connect the Smart Pulley sensor to the MultiLogPRO or TriLink's digital sensor input (starting from I/O-1).
3. Click **Setup** on the main toolbar.
4. Select **Smart Pulley** from the drop-down menu near the sensor input.
5. Program the data logger's sample rate and number of samples.
6. Click **Run** on the main toolbar to start the measurement.

### *Selecting measurement*

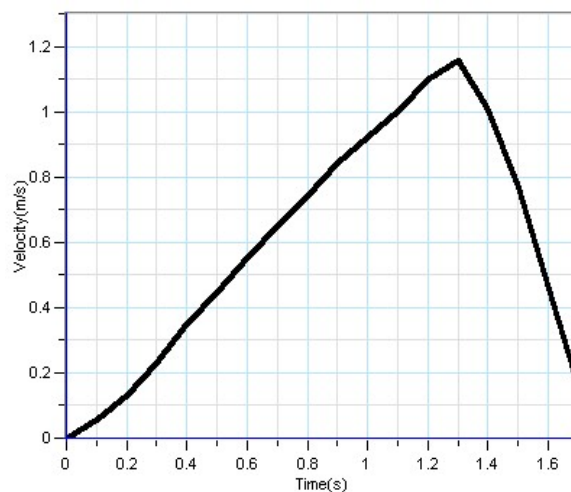
By default, MultiLab displays the Velocity measurement. To display other measurements such as Position or Acceleration use the Sensor Properties dialog:

1. Click **Setup Wizard**  on the main toolbar.
2. Click **Properties**  next to the Smart Pulley sensor input.
3. Check the checkboxes next to the desired measurements to select them.
4. Click **OK**.

## **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 vs. 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**

## **Technical Support**

Please contact Fourier technical support as follows:

Web: [http://www.fourier-sys.com/support\\_support.html](http://www.fourier-sys.com/support_support.html)

Email: [support@fourier-sys.com](mailto:support@fourier-sys.com)

Consult the FAQs before contacting technical support:

[http://www.fourier-sys.com/support\\_faq.html](http://www.fourier-sys.com/support_faq.html)



## **Copyright and Warranty**

All standard Fourier Systems sensors carry a one-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.