

## Force Sensor

Product Number: ENFRC272



### Overview

The Force sensor is a dual range sensor, capable of measuring pushing and pulling forces. It has two ranges:  $\pm 10$  N or  $\pm 50$  N. It can be easily mounted on a ring stand or dynamic cart, or used as a replacement for a hand-held spring scale.

The Force sensor can be connected to all types of einstein™ Tablets, einstein™LabMate™, and einstein™LabMate™+. It can be used for various Physics experiments.

### Typical experiments



#### Physics

- Studying Hooke's law
- Measuring frictional forces
- Measuring force on a dynamic car
- Studying simple harmonic motion
- Studying force and impulse during collision

## How it works

The Force sensor uses strain gauge technology to measure force, based on the bending of a beam. Strain gauges attached to both sides of a beam in the sensor change resistance slightly as the beam bends. Resistors are built into a bridge circuit such so changes in resistance create a small change in voltage. An amplifier circuit inside the sensor adjusts this voltage so it can be measured. Potentiometers in the amplifier circuit adjust the voltage when no Force is applied. This design produces voltage that varies linearly with force.

## Sensor specification

Range:	-10 N to +10 N -50 N to +50 N
Accuracy:	±2 % over entire range
Resolution (12-bit) for ±10 N	0.005 N
Resolution (12-bit) for ±50 N	0.025 N
Default Sample Rate:	10 samples per second

**Note: sensor cables sold separately**

## Technical Notes


Tare the output to zero Newton before each use by disconnecting the Force sensor from the data logger and reconnecting; always tare with the sensor in the orientation that will be used during the experiment.

## Calibration

The Force sensor is shipped fully calibrated. The sensor can also be calibrated within the program. The sensor has two ranges: ±10 N or ±50 N. To choose the desired range, go to full setup and click “manual”. In the Name box, chose between 10N or 50N.

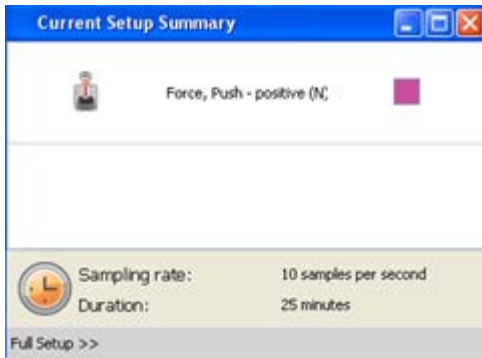
## Data logging and analysis

### MiLAB™

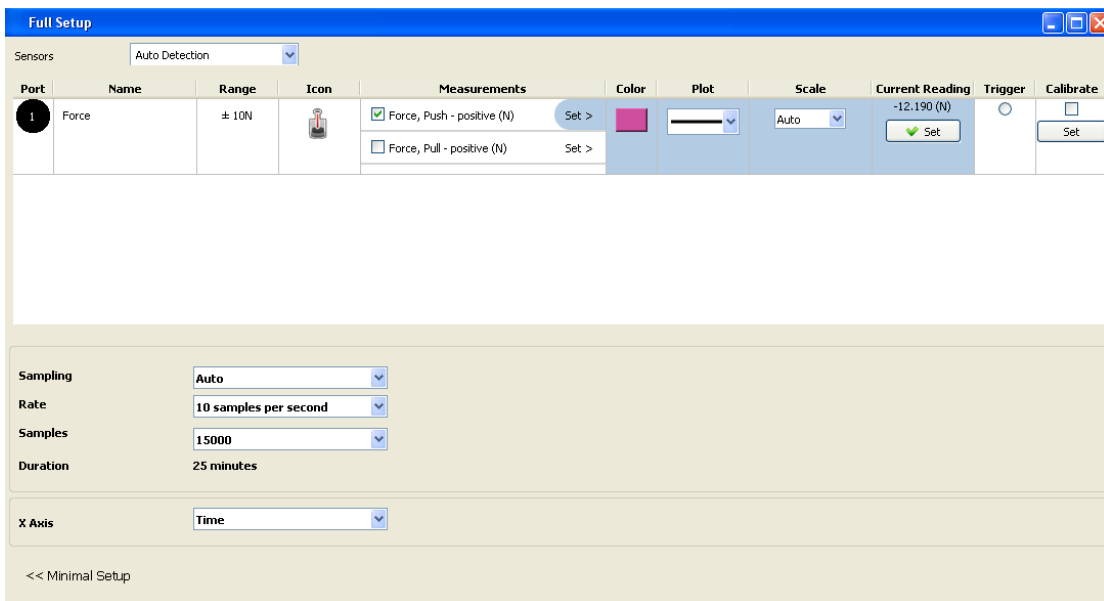
1. Take your einstein™ Tablet OR pair your einstein™LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLAB
4. MiLAB will automatically detect the sensor and show it in the Launcher View
5. Check the icon next to the sensor (  ) to enable it for logging

### MultiLab4™

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. Launch MultiLab4
4. MultiLab4 will automatically detect the sensor and show it in the Current Setup Summary window



- 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

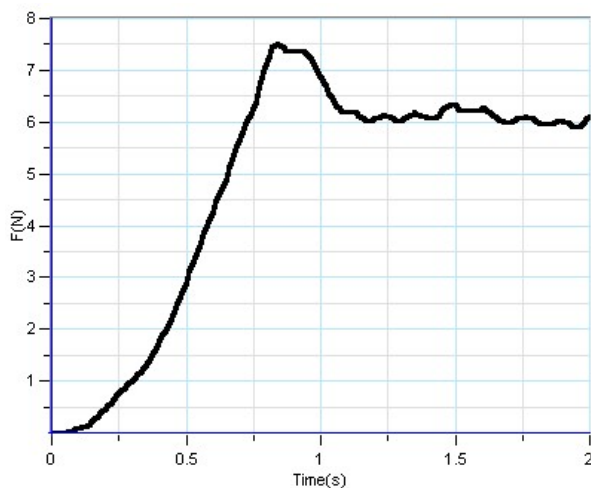


- Click the Run button ( ) on the main toolbar of the Launcher View to start logging

## An example of using the Force Sensor

### Dynamic and static friction force

An increasing force is exerted on a block which is at rest. This force is equal to the static friction and is measured using the Force sensor. When the block starts to move, the static friction changes into kinetic friction and decreases. The graph below shows the change from static friction to kinetic friction.



## Troubleshooting

If the Force sensor isn't automatically recognized by MultiLab4/ 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](http://www.einsteinworld.com/support)

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

Phone (in the US): (877) 266-4066

## 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.

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