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: ±10 N or ±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™ data loggers.
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
Recommended Sample Rate:	500 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.
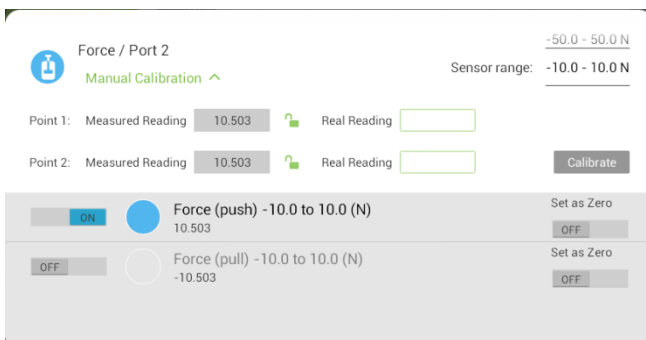
Calibration

The Force sensor is shipped fully calibrated.
For greater accuracy the sensor can also be manually calibrated

MiLAB

1. Tap the Setup button next to the sensor's name


2. Tap Manual Calibration

3. Prepare a force of known value (e.g. 5 N). Enter this known value in the Point 1, Real Reading field
4. Measure the force and wait for the readings to stabilize.
5. Tap the lock icon 🔒
6. Prepare a second force of a different known value (e.g. 10 N). Enter this known value in the Point 2, Real Reading field
7. Measure the force and wait for the readings to stabilize.
8. Tap the lock icon 🔒
9. Tap Calibrate.

Note: For the most accurate results try to calibrate the sensor with one Real Reading under the expected results and one Real Reading over the expected results.

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
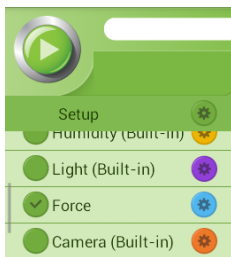
5. Make sure the icon next to the sensor is checked (✓) to enable it for logging
6. Tap the Setup icon next to the sensors to set the range being measured
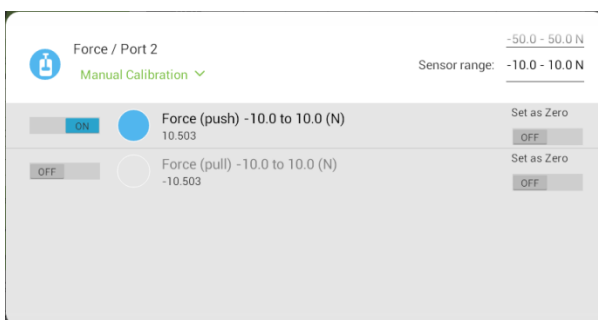
## MiLAB™Desktop

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. Launch MiLAB
4. MiLAB will automatically detect the sensor and show it in the Current Setup Summary window
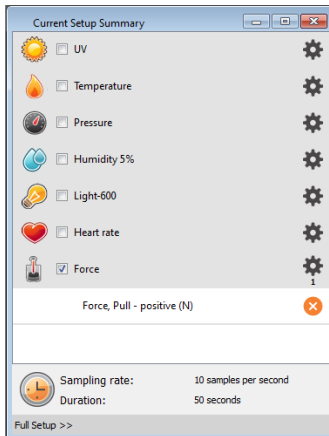
5. Click Full Setup, located at the bottom of the Current Setup Summary window to program the data logger's sample rate, number of samples, units of measurement, and other options
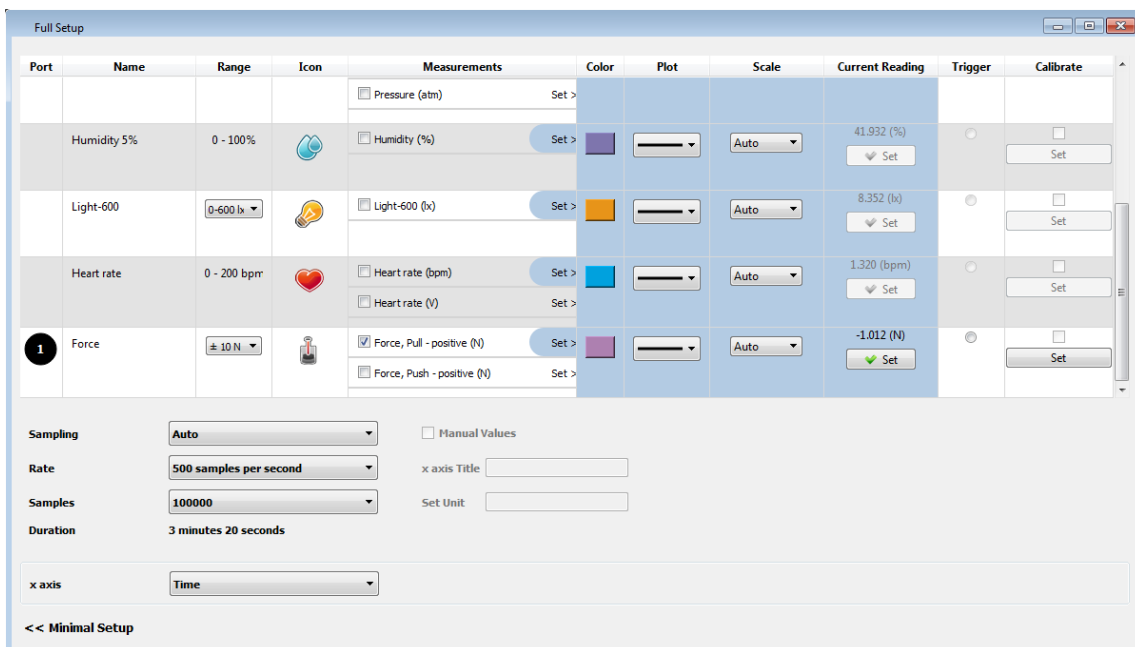

6. Click the Run button ( ) to start logging

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.
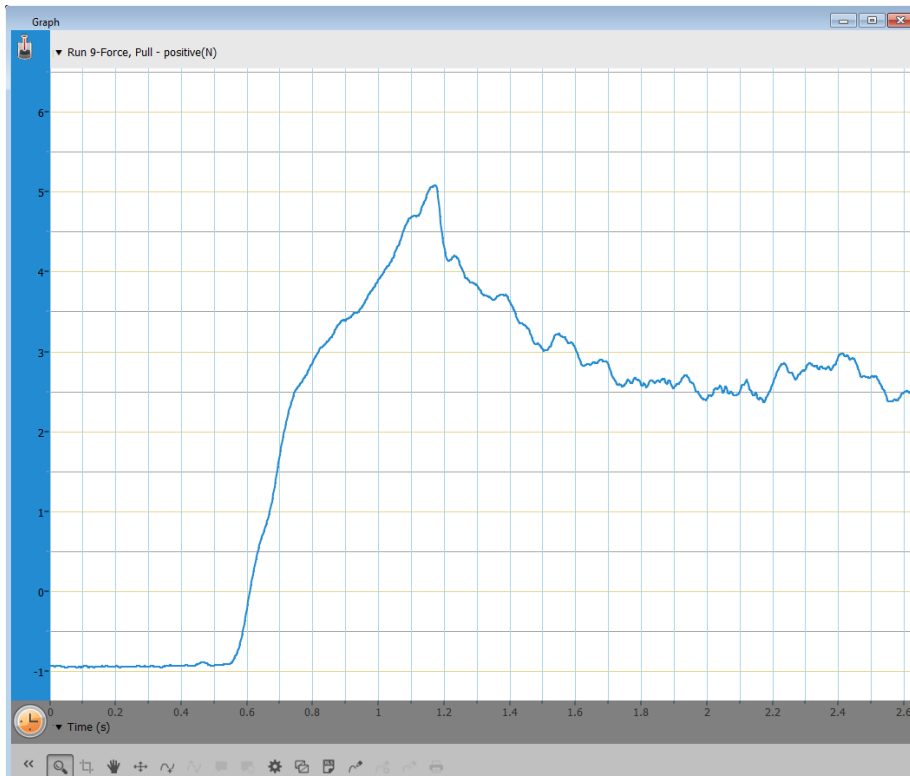
A typical graph produced by this experiment

Troubleshooting

If the Force 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
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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