

# Distance Sensor

# DT020-1



The Distance sensor can be connected to the Nova5000, MultiLogPRO or TriLink data loggers.

The Distance sensor measures the distance between the sensor and an object in the range of 0.2 to 10 m. The sensor can sample data at up to 50 times per second, making it excellent for motion and movement experiments.

It is supplied with a mounting rod and can be used for a variety of experiments in Physics.

## Typical Experiments

- Investigating dynamic cart motions on a track
- Studying motion graph matching
- Investigating simple harmonic motion, such as a mass hanging on a spring
- Measuring the free fall acceleration

## How it Works

The Distance sensor works on the same principle as a sonar system. An ultrasonic loudspeaker and microphone are located inside the sensor's case. A capacitor is connected to the loudspeaker and constantly charges and discharges according to the rate preset by the user. When the capacitor is discharged, the loudspeaker emits an ultrasonic pulse. This pulse travels through the air, hits the closest item (within range) to the sensor, and returns as an echo. When the ultrasonic microphone receives the echo, the processor inside the sensor calculates the distance according to the time difference between the two events and the speed of sound.



## Sensor Specification

<b>Range:</b>	0.2 m – 10 m
<b>Accuracy:</b>	2% over entire range
<b>Resolution (12-bit):</b>	2.44 mm
<b>Sampling Rate:</b>	Up to 50 samples per second
<b>Receiver Viewing Angle:</b>	$\pm 15^\circ$ to $\pm 20^\circ$
<b>Features:</b>	Reports position, velocity and acceleration
<b>Data Logger Input Type:</b>	Digital
<b>Recommended Sensor Usage:</b>	Operate while the AC/DC adapter powers the data logger

## Technical Notes

- As this sensor is current consuming, it is highly recommended to operate it while the AC/DC adapter powers the data logger.
- The Distance sensor has to be connected only to the data logger's digital inputs which are the first or the second inputs on the MultiLogPRO or TriLink and all the inputs on the Nova5000.
- Ensure that target object is no closer than 20 cm the sensor.
- Improve the target by adding a large and flat surface to reflect ultrasound. If the reflecting surface is an irregular reflecting surface, sometimes the waves are reflected back and sometimes not.
- Remove interfering objects near the target object or sensor. Note that the Distance sensor will report the distance to the closest object such as chairs and tables in the cone-shape area about  $20^\circ$  off the axis of centerline of the beam.

## Calibration

The Distance sensor is shipped fully calibrated.

## Using the Distance Sensor with the Nova5000 and MultiLab Software

1. Launch the MultiLab CE software.
2. Connect the Distance sensor to the Nova5000's digital sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

### *Selecting positive direction*

By default in MultiLab CE, the displayed position measurement and the positive direction is outgoing (from the sensor). To reverse the positive direction (incoming to the sensor - positive), use the Sensor Preference dialog:



1. Click **Logger** on the main toolbar.
2. Click **Preferences** and open the dialog box near **Distance positive direction**.
3. Select the desired option.
4. Click **OK**.

## Using the Distance Sensor with the MultiLogPRO or TriLink and MultiLab Software


1. Launch the MultiLab software.
2. Connect the Distance sensor to the data logger's sensor input (starting from I/O-1). The sensor is automatically recognized by the MultiLab software.
3. Click **Setup** on the main toolbar and program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

### *Selecting positive direction, position, velocity, acceleration*

By default in MultiLab PC, the displayed position measurement and the positive direction is outgoing (from the sensor). To reverse the positive direction (incoming to the sensor - positive) or to measure velocity or acceleration, use the Sensor Properties dialog:

1. Click **Setup Wizard**  on the main toolbar.
2. Click **Properties**  next to the Distance sensor input.
3. Check the checkboxes next to the desired option to select it.
4. Click **OK**.

## Setting the Current Reading of the Distance Sensor to Zero

1. Launch the MultiLab software (from either your PC or Nova5000).
2. Connect the Distance sensor to the data logger's first sensor input I/O-1.
3. The Distance sensor is automatically recognized by the MultiLab software.
4. Click **Setup** on the main toolbar.
5. Click **Properties**  next to the Distance sensor input.
6. Click the **Set Zero** tab.
7. Select the **Set the current reading to zero** checkbox.
8. Click **OK**.
9. Program the data logger's sample rate and number of samples. Click **Run** on the main toolbar to start the measurement.

## An Example of using the Distance Sensor

### *Motion on the inclined plane*

In this experiment we place a cart on an inclined friction free plane and explore the properties of the motion. The displayed graph is the position of the Cart vs. Time.

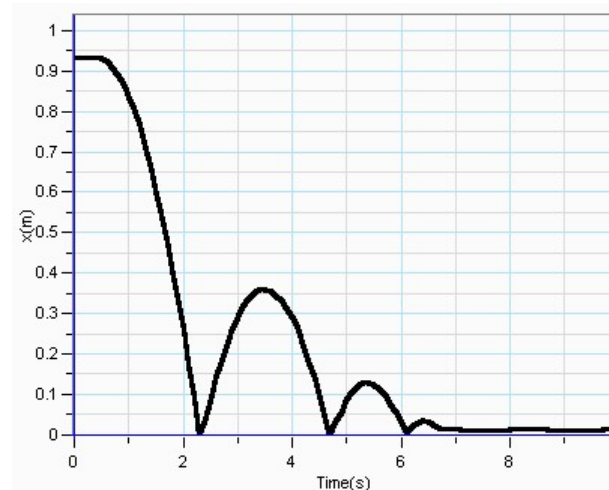


Figure 1: Position of the cart vs. Time



## **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.