

Overview

LED indicator ring

Rotates clockwise/anticlockwise depending on which direction the object is moving

Ultrasonic transducer

Range from 200 - 5000 mm or can display echo time in micro seconds



Multicolour indicator

Colour corresponds to the sensor channel on the computer screen and flashes when logging

Base plate hole

Can be used to hold Ranger in different locations

Getting started with uLog ranger

1 Insert the CD and install SensorLab

(see last page for more information)



2 Run SensorLab and plug your uLog sensor into a free USB port

You should see live readings from your sensor on the screen
(note minimum distance from Ranger is 200mm)



3 Once the software is running select 'Start'

You should see a graph recording your live readings

4 To mark an event, click on the 'Mark' icon

You will add a small arrow marker at the top of the graph

5 To stop logging, click on the stop icon

Your graph will show the complete set of data



Congratulations, you have recorded your first set of data using uLog!

More with SensorLab

You can use SensorLab to do much more than display live readings and a graph. Just hover the pointer over any icon to see what it does. Full details of all SensorLab functions are in the comprehensive user guide on the CD - here are a few of the extra features you can explore:

- **Change range or calibration of a sensor:** Click the icon above the gauge when you start
- **Change logging type: SensorLab defaults to automatic logging**
- **Switch a sensor display on or off:** Click on gauge display or when graphing click on tick
- **Zoom in on a graph:** Draw a box around where you wish to zoom or click Magnifier icon
- **Take precise readings from graph:** Click on graph & position cursor with mouse or arrows
- **Label different points on the graph:** Click **IA** icon or Graph / Annotate
- **Change SensorLab complexity level:** Click level icon bottom right of screen to increment
- **Find information about the experiment:** Click on the *i* icon
- **To print graph:** Click on the Printer icon or select menu File / Print menu
- **Save SensorLab file onto your computer:** Click Disc icon or use File / Save As menu
- **Export data in a different format for use in another program or share:** File / Export menu

Using multiple uLog sensors

You can connect several uLog adapters and sensors to the same computer for multi channel logging on the same graph. The multicolour LED on each uLog will show which sensor is displayed on which channel (especially useful if using several sensors of the same type). Note that the number of uLog sensors you can use is dependant on the computers processing power, number of USB ports available and the USB power available (particularly limited on smaller computers). Use a high quality **powered** USB hub to increase both number of USB ports and power capacity. You can move uLog sensors further away from the computer by using a USB extension cable.

Other SensorLab functions

As well as graphs, SensorLab can also display data from some sensors in different ways.

Oscilloscope: Some analogue sensors which respond quickly (such as sound, light, voltage) can be also displayed as a live oscilloscope waveform on your computer screen - to view the output of a sensor as a waveform click the oscilloscope icon on the home screen. You can also store and transfer the screen data onto the normal graph for later analysis.

Setup: The setup icon on the home screen (cog wheel) enables you to change the types of logging. You can also select Timing from this option to use with sensors such as Light Gates etc. Full details of the scope & all SensorLab functions are in the comprehensive user guide on the CD.

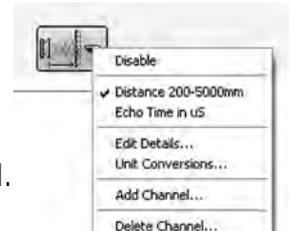
In use

The uLog Ultrasonic Ranger works by sending an ultrasonic pulse at a target and waiting for the return echo - the time taken to receive the echo, given the speed of sound, equates to twice the distance between the Ranger and the target. Ranger can display distance (default) or echo time - the change of speed of sound through air due to temperature can also be simultaneously recorded by using a uLog temperature sensor in another USB socket on the computer.

Around the ultrasonic transducer is a ring of 8 LEDs. These are used to indicate the detection of a target object and will rotate clockwise/anticlockwise depending on which direction the object is moving. These LED's aid in the setting up of experiments so that an object can be aligned correctly before logging begins. Note the minimum distance from a target is 200mm. A hole is provided in the base plate which allows the Ranger to be mounted in different locations. The power to the sensor is supplied by the computer - make sure your USB socket is capable of powering this sensor (especially portables) or use a powered hub.

Selecting an alternate scale

With the uLog Ranger, you can select between 'Distance' or 'Echo time in uS'. To do this, start the SensorLab software and connect the uLog ranger sensor. Click on the little down arrow above the sensor to select which scale is required.



Troubleshooting

Q. Ranger cannot 'see' the object or target?

A. This can be caused by a number of issues

- i) The target is too small. Try using 15cm x 15cm as a minimum if using an air track and by using the LED motion display to make sure the Ranger can 'see' the target along the whole length of the track. Solid flat surfaces work best.
- ii) The target is not reflecting back the sound wave properly. If using Ranger to track a person (eg Time/Distance graph), ask them to hold a flat piece of card as a target as sound waves can be absorbed by clothing and not echoed back, giving erratic readings.

Q. My results have spikes or 'odd' readings?

A. This can occur when an echo is lost or reflections from walls or other objects are received by the Ranger. To avoid this use a large flat target and ensure it is accurately aligned. If using more than one Ranger in a room, ensure they are far enough apart to prevent sound waves interfering.

Ideas for experiments.....

Simple Harmonic Motion

By using a Ranger and a piece of card as shown, monitor the SHM of a spring.

You can extend the experiment by varying the mass.

What effect would this have on the recorded data?

Investigate starting at a different displacement.

Does this effect the recorded data in any way?

How might you investigate the extension of a spring with increasing mass?



Speed of Sound in Air

Select the echo time scale within SensorLab (as above). Because the echo time is the time taken to travel to the object and back, divide by 2 to obtain the time taken to reach the object. Convert to seconds and then substitute into the following equation:

$$\text{Speed of sound (m/s)} = \text{Distance for echo to travel} / \text{Echo time (s)}$$

The Distance for echo to travel can be measured using the Ranger itself.

You can check your results by using a uLog temperature sensor, measure the temperature of the room (θ in $^{\circ}\text{C}$) and substitute into the following equation to obtain the speed of sound.

$$\text{Speed of sound (m/s)} = 331.3 \times \sqrt{1 + (\theta / 273.15)}$$