1270PK - Speed of Sound Pack

Revision: 0 | DS193

Table of contents

Introduction

Thank you for purchasing the Smart Wireless Speed of Sound Pack.

We pride ourselves on producing high quality products that meet with the demands of the busy classroom environment.

If you have any problems using this instrument, please read this documentation in full before contacting the Data Harvest support team.

Overview

The Smart Wireless Speed of Sound Pack is for evaluation of the speed of sound through gases, and solids. By examining this property, it is possible to understand mechanisms for energy transformation, and how those are influenced by the type of material used.

The speed of sound is measured by seeing how long it takes for sound to travel a fixed distance. By using this sensor pack, the time delay as a sound wave moves from one position to another can be measured conveniently and easily.

Pack Contents

This product is supplied with the following items:

- 1 × Smart Wireless Speed of Sound Sensor
- 1 × Pair Speed of Sound Microphones
- 1 × USB Connecting Lead

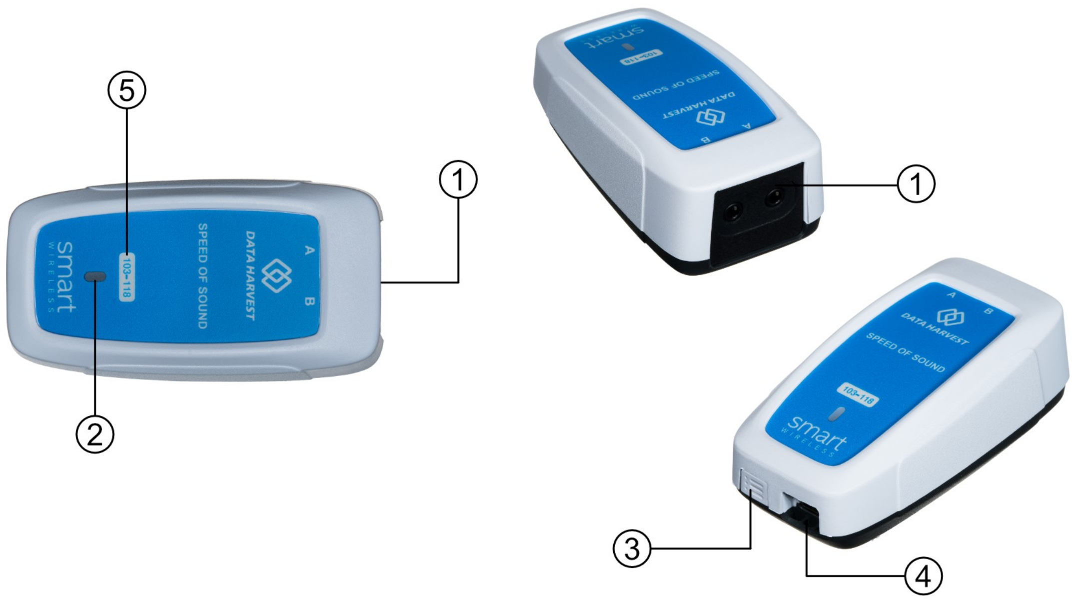
Additional Accessories

To get the most from your Smart Speed of Sound Sensor, the following item should be considered:

- Smart Wireless Temperature Sensor

Operational Overview

The diagram below shows the specific parts of the sensor. Read further to explore the functionality of each part of the sensor.



The diagram below shows the specific parts of the sensor. Read further to explore the functionality of each part of the sensor.

1. Sensor End Connector
2. Status Indicator
3. On/Off Switch
4. USB Port
5. Unique ID Number

Sensor End Connector (1)

Most Smart Wireless Sensors feature an end connector that is specific to the requirements of the device's internal sensor. The sensor's end connector is the direct interface between the device’s internal electronics and your experiment.

The Status Indicators (2)

The sensor features a single status indicator that changes colour and flashes. See the table below for further information.

Status Light		Indicates
No light		Sensor is Off. Short press the On/Off switch
Blue flashing		Sensor is On and Bluetooth advertising
White flashing		Charging via USB mains charger or USB port, Sensor is On and Bluetooth advertising

Red, Green, Blue Flashing		Charging via USB mains charger or USB port, Sensor is Off
Green flashing		Communication with the EasySense app (via USB or Bluetooth) established
Solid Green		Fully charged
Orange flashing		Recording data, a fast pulse indicates awaiting trigger in Remote Mode
Red flashing		Battery is low

On/Off Switch (3)

The sensor's on/off switch allows you to turn the sensor on, off or perform a hard reset.

To switch the sensor off

- Press and hold down the On/Off switch until the white light shows, then release.
- If not communicating with the EasySense app, the sensor will turn off after a period of one hour of inactivity.

Hard resetting the sensor

- If necessary, attach the sensor to power.
- Press and hold down the On/Off button for at least 8 seconds until the status LED gives a flash of blue light, then release.
- If the sensor fails to respond, contact Product Support at Data Harvest. Please provide details of:
    - The computer platform with and the EasySense app's version number.
    - A description of the problem encountered.

USB Port (4)

Use to connect to a computer or a charging unit.

For specific USB or Bluetooth connectivity instructions, please see the 'Connectivity' section of this documentation.

For instructions on charging your device, see the section on 'Charging the Sensor'.

Unique ID Number (5)

All Smart Wireless Sensors have a unique ID number. This number is identified within in the EasySense app, so that you can identify each sensor when making a connection.

Microphones

This pack contains two microphones in a stethoscope format. Connected by the user, one is assigned to Port A and the other to B on the sensor input, in the Sensor End Connector (1), above.

Each microphone has a removable protective cover, located on the housing (4.5 cm diameter).

The microphones use 3.5 mm jack plugs (1.4 m cable length each) for connection to the sensor. For longer "time-of-flight" measurements, an extension lead of (3 m) to allow a 5.8 m separation between microphones is required (not supplied).

The Sensor and EasySense

Please make sure that you use the latest release of the EasySense series of software. Both collection and analysis of data is available here, on a variety of operating systems.

Direct Data Logging

The sensor is designed to work directly with EasySense (as an installed application or PWA). A full compliment of experiments can be run by using the sensor through Bluetooth™ or USB. EasySense will support direct logging and data storage when connected as above.

Remote Data Logging

The ability to capture data independently (free of a capture station) is done through EasySense's Remote Mode.

This facility may be found in EasySense, under Setup. Once the conditions for data collection have been established, the sensor can be set to initiate collection for example, using a rapid press of the power button. Initiation of the experimental data collection by the software is followed by remote detachment; collection is then on the sensor.

Data gathering is realised by using Setup once again.

Details are given in the latest EasySense User Guide.

Connectivity

The sensor is both USB and Bluetooth compatible. Install the EasySense app, if it is not already on your device. For details of how to operate the EasySense app, please refer to the EasySense documentation.

USB Connectivity

Quick Steps

1. Connect the sensor to the computer's USB port using the USB cable supplied.
2. The computer will automatically detect a new device and depending on your operating system, will install any applicable device drivers.
3. Start EasySense app.
4. Within the EasySense app, the Devices icon will change to green to show that the sensor is connected, and the status light on the sensor will also turn green.
5. Begin your practical investigations.

Bluetooth Connectivity

Using Bluetooth, the sensor can wirelessly connect to mobile devices such tablets and mobile phones, as well as desktop or laptop computers, giving students the ability to run experiments independently without being tethered to a device.

See the EasySense app user manual system requirements for further details.

Quick Notes on Bluetooth Connectivity

Only use with the EasySense app, you do not need to pair the device. If paired, the sensor will not be available to the EasySense app.

Computers or devices will need to support Bluetooth Low Energy (BLE). For further information refer to the instructions provided for the EasySense app.

Quick Steps

1. Short press the on/off switch to turn the sensor on, blue LED will flash.
2. Open the EasySense app.
3. Select the Devices icon.
4. Select your sensor from the list of available sensors to connect to the device. Your sensor is identified by its unique ID in the list.
5. Click on connect at the side of your sensor in the list.
6. The Devices icon will change to green and the status light on the sensor will flash green to indicate a connection has been established.
7. Begin your practical investigations.

Charging the Sensor

The Smart Wireless sensors are fitted with a rechargeable lithium-ion battery and can be charged via the USB port. Use the supplied USB lead to connect the sensor either directly to a USB port on your computer, a powered USB hub or a USB mains charger that outputs 5 V at 500 mA or more.

A full charge can take up to four hours.

Additional Information

Whenever the sensor is connected to the USB port on the computer or to a USB mains charger (output 5 V at 500 mA or more), it will automatically recharge the battery (LED status flashing white).

When connected to a computer, the computer should be turned on and not in sleep or standby mode, as the battery may drain instead of charge.

The sensor will stay awake for five minutes when Bluetooth advertising (LED status flashing blue).

Lithium-ion batteries are ‘memory-free’ and prefer a partial rather than a full discharge. Constant partial discharges with frequent recharges will not cause any harm. Frequent full discharges should be avoided whenever possible. Ideally the sensor should be stored at about 40% or more charge.

The speed at which a lithium-ion battery will age is governed by both its storage temperature (preferably less than 40℃) and state-of-charge.

Firmware Updates

Occasionally Data Harvest may release updated firmware which will contain improvements or new features.

Updates will take place when you connect your sensor to the EasySense app. You will be given the option to decline an update.

Updates can be performed over USB or Bluetooth and will typically take less than one minute. Updating firmware over USB will be quicker than Bluetooth.

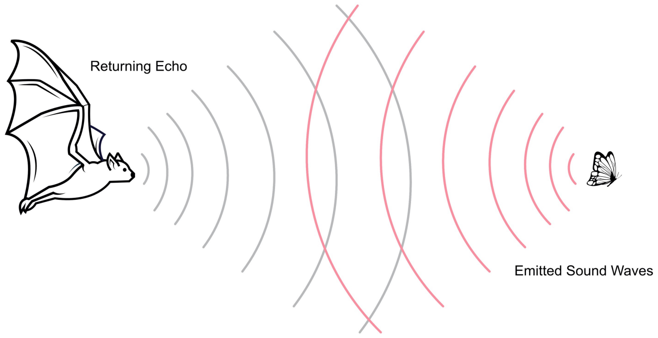
Do not disconnect the sensor, or power off during the update.

If you have a wireless connection to the EasySense app, the sensor will have to be reconnected after performing the update.

Usage Information

The speed of sound and its importance are evident all around us. You may have noticed that a lightning strike and the associated thunder do not coincide. This informs us that speeds involved are different.

Bats use their fine-tuned sense of sound to navigate around the world: the time delay for the echo they detect is related to the distances involved. This is part of animal echolocation, and animals such as odontocetes (toothed whales) use sonar for these purposes.



William Derham was the first recorded person to measure the speed of sound, in the late 17th / early 18th century. He used a simple method of creating a sound wave and measuring how quickly it reached two points. Knowing the distance separating these points and the time taken to reach them, the observer could calculate the speed of sound. The experiments described in Data Harvest's associated practical work sheets use a method similar to that used by William Derham.

Modern technology reduces the distance between the "listening points". With two microphones at a known distance apart, the time taken for that noise to travel between microphones is a direct link to the speed of sound. A simple calculation of distance divided by time gives the speed. Since the sound profile is known, we can analyse the experiment in diverse ways, and are not reliant upon interpretation of when a wave front arrives at one point or another. Alternatively, following a sound wave "bouncing" back and forth from one surface to another gives a frequency. This characteristic frequency, when analysed, provides another way to measure the speed of sound.

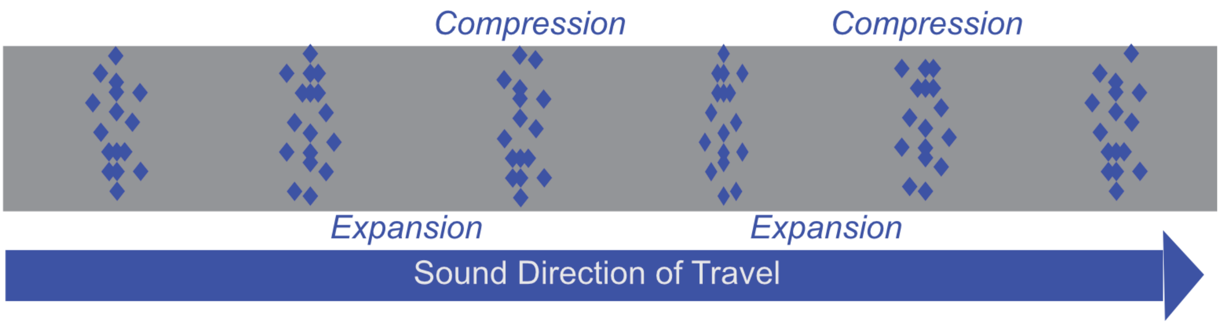
Sound Propagation

Sound is a vibration that travels through an elastic substance. The vibration causes areas of compression and expansion forming a longitudinal wave, which can show properties of reflection.

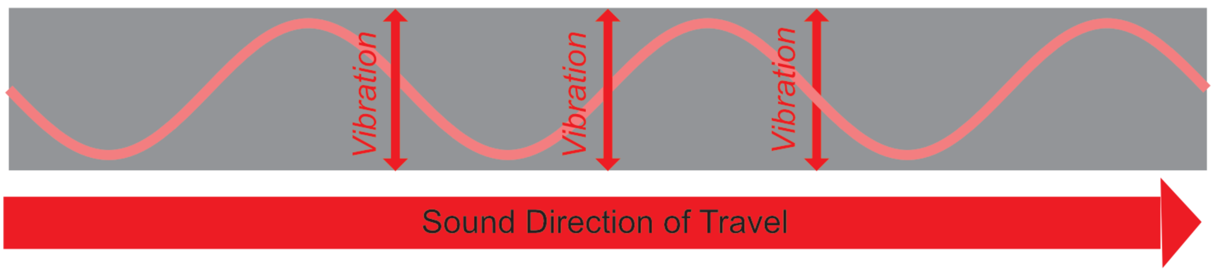
As a rule, the greater the elastic properties of a material the faster the speed of sound, c. In air (a mixture of gases) at a temperature of 0ºC, sound travels at 331 metres per second. As the temperature increases the speed also increases (by approximately 0.607 $m\ s^{-1}\ ^{o}C^{-1}$). The speed of sound in air is independent of pressure and density for small temperature ranges.

Speed travels about four times faster in water than air and this multiple is temperature dependant. In solids additional waves related with shear and extensional modes may also be present. These additional waves can lead to widely varying speed values cited in the literature.

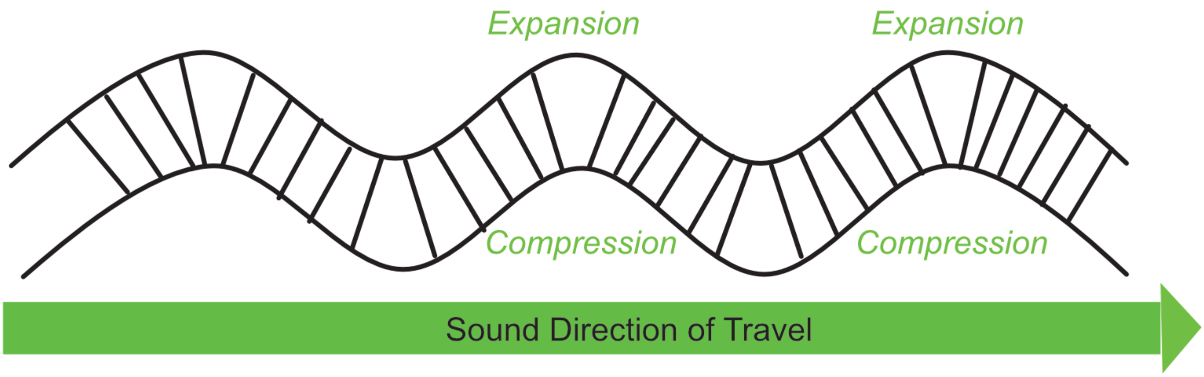
Longitudinal Wave



Transverse Wave



Extensional Wave



Speed of Sound Value and Transit Time

Material	Longitudinal/m s^{-1}	Shear/m s^{-1}	Extensional/m s^{-1}	Transit time (1 m)/ms
Air	340	N/A	N/A	2.94
Water	1498	N/A	N/A	0.67
Glass (Pyrex)	5640	3280	5140	0.17 – 0.30
Aluminium	6420	3040	5000	0.160 – 0.33
Steel	5940	3100	5180	0.168 – 0.32
Brass	4700	2110	3480	0.21 – 0.47
Gold	3240	1200	2030	0.308 – 0.83

Values are at 1 atmosphere 25 ^{0}C, Source-engineeringtoolbox.com

The quoted speed of sound in air value is often a calculated rather than by direct measurement. The formula used to calculate the speed of sound in air produces satisfactory results over a wide range of temperatures but starts to fail at elevated temperatures. Good predictions of the speed of sound in the atmosphere are possible, especially in the colder, drier, low-pressure stratosphere.

When longitudinal waves are present - the disturbance travels in the same direction as the sound. In solids, the picture is often more complex as shear waves can also be present. The vibrations of these are at right angles to the sound propagation. Extensional mode waves travel as above, which can contribute.

Measurement Strategy

Sound is a disturbance moving through a media. If it can only travel as a unidirectional pulse (longitudinal) then, we can measure the time taken for it to travel a certain distance. This is the "time-of-flight". This will be the case in gases, fluids and with longer distance measurements involving solids.

Solids can support more complex modes of propagation (see above). Transverse waves are usually slower than longitudinal waves. They do not progress at an interface (say an air boundary) and convert back to their longitudinal alternative. With no interface, one can make use of time-of-flight across the material. If the sound wave encounters two interfaces, such as air at either end, then it will "bounce back" and resonate, or ring. Here we can use resonance analysis to map the speed of sound, such as that exhibited in a short metal rod.

Usage in EasySense

1. Connect the microphones to the sensor unit and turn on.
2. Activate your EasySense app and select Devices. Connect the sensor.
3. In the Devices dialogue, select the data that you wish to display.
   The parameters that are relevant for your experiment, you selected here.
3. Select Continuous, Interval required, pre-trigger (Start) and Stop sample number needed.
4. Start to initiate experimentation.

General Recommendations

1. Do not expose the microphones directly to water.
2. If clamping the microphones, apply only a gently pressure.
3. For long "time-of-flight" studies, employ a four mm jack extension cable (not supplied).
4. Please observe the Notices Section in this document.

Usage Recommendations for Air

1. Use 1.0 m to separate the microphones.
2. Position the microphones so that they are facing or at right angles to the sound propagation. If facing, then ensure
   that microphone A does not block the path of B.
3. Arrange so that you create the noise behind the first microphone A.

4. Try to use a dedicated device to generate the disturbance.
   For air, an inexpensive fast "clicker" is ideal to generate a sound wave.
5. Try to isolate any sound-reflecting surfaces from the experiment.
6 Should you wish to explore supersonic behaviour, try using a balloon burst!
7. Using Setup, select Start "When Value Rises Above" and set default conditions there.
   A pre-trigger delay and fixed number of samples "Stop" condition work well.

Specific Usage Recommendations for Solids (Metals)

Trying to invoke sound in sections of metal can come with problems. Mechanical generation of sound will set off a complex series of vibration modes that can be difficult to differentiate. To simplify experimental behaviour, however, we recommend the following.

Time-of-flight (long section)

1. Use a long piece of metal (fence, stair rail) > 5 m for time-of-flight.
   In this mode the microphones effectively function as accelerometers.
2. Use a small hammer, and record the disturbance arrival times at A and B.
   The equation below may then be used, after analysis, to calculate the speed of sound.
3. Try using "G" clamps to hold the microphone gently against the surface.
4. Use a software trigger available from the Setup dialogue.
   Try using a pre-delay of fifty microseconds and a few milliseconds data gathering.
5. Select Start "Value Rises Above" and set default conditions there.
6. A pre-trigger delay and fixed number of samples Stop condition work well.
7. Use the fastest interval possible.

Resonance studies (short section)

1. For resonance, use a metal rod > 1 m with diameter circa 10 mm.
2. Try not to use rolled metal.
3. Suspend the rod, at either end, using elastic straps attached to a supporting rod.
   A ribbon attached to the centre of the rod can dampen half-wave harmonics.
3. Use a light hammer, face on, to generate the resonance.
4. To help understand the calculations, try to use ‘sensible’ sections, e.g., 1 m.
5. Use a software trigger, if possible, available from the Setup dialogue (above).
   Select Start "Value Rises Above" and set default conditions there.
6. A pre-trigger delay and fixed number of samples Stop condition work well.
7. Use the fastest interval possible.

Theory

The mathematics behind sound advancement are quite accessible. The speed of sound, c, is expressed:

$$c = \sqrt{(E_p/\rho)}$$

where E_p is a measure of the elastic properties and ρ is the density.

Gas

The speed of sound c is a result of compression waves. With an ideal gas:

$$c = \sqrt{(\gamma RT/m)}$$

here γ is the ratio of the specific heat capacities (C_p/C_V) and m is the molar mass of the gas (kg mol^{-1})

or:

$$c = \sqrt{(\gamma kT/m_0)}$$

where m_0 is the molecular mass of the gas molecule(s) involved (kg).

Setting $\gamma = C_p/C_v = 1.4$, $R = 8.3$ J mol^{-1} K^{-1}, $m = 2.9 \times 10^{-2}$ kg mol^{-1}, T = 273 K, c is 327 m s^{-1}.

Also, the speed of sound is related to the average speed of diatomic gas molecules, c_1:

$c_1 = \sqrt{(3kT/m_0)}$

For nitrogen ($m_0 = 4.64\times10^{-26}$ kg), at 273 K, c_1 is 493 m s^{-1}.

or:

$c_1 = c \times (\gamma/3)^{-0.5}$

which is a remarkably interesting relationship to have!

Liquid

With a liquid, shear forces are not available and so we may express the speed of sound:

$c = \sqrt{(B/\rho)}$

where B is the bulk modulus. The Bulk modulus is a way to express the reduction in volume of a fluid with an applied pressure. For water, B = 2 GPa or 2×10^9 kg m s^{-2}, $\rho = 1 \times 10^3$ kg m^{-3}, yields a value of c = 1000 m s^{-1}.

Solid

The situation is a little more complex in a solid, as both compression and transverse waves can make up the speed of sound (see above). Transverse waves oscillate in a direction which is perpendicular to the direction in which the wave is advancing.

Solids support elastic deformation: compression waves travel at different speeds to the transverse wave. During an earthquake, what is often experienced is the initial shock and then the rocking behaviour exhibited by transverse waves comes a little after the first compression wave.

A flat surface, such as a bench top, will contain different velocities and wave echoes. The cross section (and area) of the material will also have an influence.

If the solid is a flat rod, then the velocity of sound will be dependent upon the shear and Young's modulus of the material. In the case of a shear wave:

$c = \sqrt{(G/\rho)}$

where G is shear modulus. For steel, G = 210 GPa or 2×10^{11} kg m s^{-2}, $\rho = 8 \times 10^3$ kg m^{-3}, yields a value for $c = 5 \times 10^3$ m s^{-1}. Shear waves cannot progress when they enter a boundary such as air and convert back to longitudinal waves.

In the case that the speed measured as a longitudinal wave pressure front dominates, the above reduces to:

$c = \sqrt{(E/\rho)}$

and E is Young's modulus.

Long section (>4 m) "time of flight"

We can measure the time separation for a sound disturbance front, when the longitudinal wave is cleanly separated from effects of shear, reflection, and other more advanced modes in the following. This would apply to a sample that is long enough to easily detect the oncoming front.

If one has a large separation, l, between the microphones and the sound transmission is unidirectional, the speed of sound (fastest) is the rate measured when separation between initial pulse front (location A) progresses to location B, with a time-of-flight, t, resulting in:

$c = l/t$

By measuring across a large separation between the microphones, we can estimate the speed of sound.

Short section (1 m) "resonance"

The speed of sound (longitudinal) along a rod or bar of length, l, will exhibit a major frequency, f. The longitudinal pulse can bounce back and forth but also impart its frequency to the air when it encounters an air interface. This is true when the diameter of the bar is insignificant compared to the overall length. These quantities are related by the formulae:

$$c = 2 \times l \times f$$ *

The characteristic (major) frequency is:

$$f = 0.5 \times l^{-1} \times c$$

$$f = 0.5 \times l^{-1}\sqrt{(E/\rho)}$$

For steel, $E = 210$ GPa or 2.1×10^{11} kg m s^{-2}, $\rho = 8 \times 10^{3}$ kg m^{-3}, yields $c = 5 \times 10^{3}$ m s^{-1}. The major frequency for a rod of length 1 m, is 2.5×10^{3} s^{-1} or 2.5 kHz.

Over a short distance, using a rod of 1 m, we can employ this method to find the value of c. One can examine the characteristic ringing that results when a metal is set into vibrational excitation governed by the speed of sound

Useful Formulae

The following formulae, are particularly useful:

speed = distance travelled/time elapsed
wavelength = speed/frequency

or

speed = wavelength × frequency

For a resonating rod, longitudinal mode:

wavelength = 2 × length of rod
speed of sound = 2 × length of rod × frequency

Faster than sound....

When a disturbance travels faster than sound, we say that it is supersonic. The Mach number, M, is a value quoted for the ratio of speed of flow velocity, u, compared to the local speed of sound, c, in a particular medium.

$$M = u/c$$

This type of energy propagation is different from when sound alone carries the disturbance. Shock waves manifest in diverse forms, from aircraft "breaking the sound barrier", earthquakes and volcanic eruptions and meteor strikes.

Practical Investigations

The Smart Wireless Speed of Sound Pack is an integral part of scientific experiments, such as:

- Determine the speed of sound in air
- Determine the speed of sound in a solid
- Specific heat capacity ratio in gases
- Young's modulus in solids
- The speed of sound in solids - why is it faster than in liquids?
- The relationship between speed of sound and shock waves
- The effect of temperature on the speed of sound - absolute zero
- Explore the relationship between speed of sound and Boltzmann's constant

Online Videos

Learn how to use data logging in the classroom with our Secondary Science Academy demonstration videos, which will walk you through using the new EasySense app and show you how to get hands-on with the latest Bluetooth wireless sensors. The video experiments will show you how to get the best out of your science lessons.

New online content is being continuously uploaded onto our YouTube channel, including practical worksheets as well as videos.

See our website for further information and links.

Explore Bluetooth Sensors

Are you looking to make the jump to our smart wireless sensors? Or have you recently purchased them and want to know more about how they work?

View video playlist

Explore EasySense

The core of our science platform is our EasySense app. In these videos you will learn everything from the basics of our software to the most in-depth features.

View video playlist

Explore Science Practicals

See our Smart Wireless Sensors in action with a range of practical experiments. This is the best way to get started with the new Bluetooth sensors!

View video playlist

Sensor Specifications

Please read the following table for sensor specifications.

Feature	Detail
Measurement Ranges	Speed A - B, Time A - B, Waveform, Microphone ADC
Accuracy	Speed of sound (±1% air and metal)
Resolution	Interval 50 µs (software)
Fastest displayed speed	20000 samples per second [50 µs]
Connectivity	Wired via USB Wireless via Bluetooth
Bluetooth Specifications	Bluetooth 4.2 low energy radio, single mode compliant Transmit (TX) power: 0 dBm Receiver (RX) sensitivity: - 90 dBm Usable transmission range: up to 10 m in open air Frequency Range: 2.402 to 2.480 GHz operation Operating range: 0 to 40℃ and 0 to 95% RH (non-condensing)
Internal Battery	Rechargeable internal lithium-ion 3.7 V
Storage/Operating Temperature	0 to 40℃
Humidity	0 to 95% RH (non-condensing)
Physical Specifications	Weight: approx. 80 g External dimensions: approx. height 33 mm x width 50 mm x length 90 mm Stethoscope: Diameter 45 mm, single cable length 1.47 m (2.94 m max separation without additional extension).

Limited Warranty

For information about the terms of the product warranty, see the Data Harvest website at: https://data-harvest.co.uk/warranty

Product Repairs

When returning goods to Data Harvest, please download and complete the repair returnform to ensure you have sent us all the information we require, and send it to us alongside the item to be repaired. The second page of this form includes a return address label.

If you have purchased a Data Harvest manufactured product via a different company, please also supply proof of purchase.

Postage Charges

- In the event of a fault developing, the product must be returned in suitable packaging to Data Harvest for repair or replacement at no expense to the user other than postal charges.
- There will be no postal charge for the return of repaired goods to any mainland UK address (for other areas, additional shipping charges may apply).

Out of Warranty Repairs

Please visit https://data-harvest.co.uk/repairs for the most up to date charges for out of warranty repairs.

Warranty on Repaired Items

Once an item has been serviced and repaired, the product will have 1 year warranty against further failure of the component repaired.

International Returns

Please contact the authorised Data Harvest representative in your country for assistance in returning equipment for repair.

Compliance

This product complies to the following standards:

Waste Electrical and Electronic Equipment Legislation

Data Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as ‘life expired’ and we will dispose of them for you.

FCC Details

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CE

This product conforms to the CE specification. It has been assessed and deemed to meet EU safety, health and environmental protection requirements as required for products manufactured anywhere in the world that are then marketed within the EU.

UKCA

This product conforms to the UKCA specifications.

Troubleshooting

If you experience any problems with your product, please try the following troubleshooting tips before contacting the Data Harvest support team.

Feature	Detail
Loss of Bluetooth Connectivity	**If the sensor loses Bluetooth connection and will not reconnect try:** Closing and reopening the EasySense app. Switching the sensor Off and then On again. If you are using a Bluetooth Smart USB Adaptor on your computer, unplug the adaptor, plug back in again and try to reconnect. Hard reset the sensor and then try to reconnect.

Notices

Please read the following notices with regards to using your sensor

1. The sensor is much smarter than traditional Bluetooth sensors and you are not required to pair the device. If paired, the sensor will not be available to the EasySense app.
2. When the sensor is connected to a computer, the computer should be turned on and not in sleep or standby mode, as the battery may drain instead of charge.
3. Data Harvest products are designed for educational use and are not intended for use in industrial, medical or commercial applications.
4. We reserve the right to change the product specifications and documentation at any time without further notice.
5. The sensor is not waterproof.
6. Plastic parts may fade or discolour over time if exposed to UV light. This is normal and will not affect the operation of the sensor.

Contact Information

To contact Data Harvest directly, please use any of the following channels:

Traditional Communications

Data Harvest Group Ltd.
1 Eden Court, Eden Way,
Leighton Buzzard,
Bedfordshire,
LU7 4FY
United Kingdom

Tel: +44 (0) 1525 373666
Fax: +44 (0) 1525 851638
Sales email: sales@data-harvest.co.uk
Support email: support@data-harvest.co.uk

Online Communications

We have active social media support channels using the following platforms

- Facebook
- X
- YouTube

Office Opening Hours

Monday to Thursday - 08:30 to 16:45
Friday - 08:30 to 13:30
Saturday & Sunday & UK Bank Holidays - Closed

PDF Translations

The PDF formatted download of this manual is by default provided in the English (United Kingdom) language. If an alternative translation is available, it will be listed here.

We have for your convenience included a webpage translation feature to the online documentation which will allow you to translate and print individual pages of this documentation.