1145 - Wireless Sound Level Sensor

Revision: 1.0 | DS162

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Introduction

Thank you for purchasing the Smart Wireless Sound Level Sensor. We pride ourselves on producing high quality products that meets with the demands of the busy classroom environment. If you have any problems using this sensor, please read this documentation in full before contacting the Data Harvest support team.

Overview

The Smart Wireless Sound level sensor is a two channel sensor that can be used to measure accurately sound intensity level in decibels (dB) and examine the frequency content of the sound in waveform (mV). Both channels can be recorded at the same time.

It has a sufficiently fast response to capture waveforms and allow for the measurement of speed of sound using one Sound sensor.

The electret microphone used in this Sensor is equally responsive to all sound frequencies within the 20 Hz to 10 kHz range and can measure both transient and continuous noise.

The sensor is both USB and Bluetooth compatible. 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 traditional data logger. See the EasySense2 user manual system requirements for further details.

The sensor is supplied with a mini USB lead (1 m standard A to standard mini B).

Pack Contents

This product is supplied with the following items:

- [1 x Smart Wireless Sound Level Sensor](#)
- 1 x USB Connecting Lead

Operational Overview

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 Cap
2. Status Indicator
3. On/Off Switch
4. USB Port
5. Unique ID Number

Sensor End Cap (1)

Most Smart Wireless Sensors feature an end cap that is specific to the requirements of the device's internal sensor. The sensor's end cap is the direct interface between the device's internal sensor 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 On and Bluetooth advertising
White flashing		Charging via USB mains charger or USB port
Green flashing		Communication with the EasySense2 app (via USB or Bluetooth) has been established
Orange flashing		Recording data

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 EasySense2 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 it is being used with and the EasySense2 app's version number.
  - A description of the problem being 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 are labelled with a unique ID number. This number is used in the EasySense2 app, so that you can identify each sensor when making a connection wirelessly.

Connectivity

The sensor is both USB and Bluetooth compatible. Install the EasySense2 app, if it is not already on your device. For details of how to operate the EasySense2 app, please refer to the EasySense2 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 2 app.
4. Within the EasySense2 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 EasySense2 app user manual system requirements for further details.

Quick Notes on Bluetooth Connectivity

Only use with the EasySense2 app, you do not need to pair the device. If paired, the sensor will not be available to the EasySense2 app.

Computers or devices will need to support Bluetooth Low Energy (BLE). For further information refer to the instructions provided for the EasySense2 app.

Quick Steps

1. Short press the on/off switch to turn the sensor on, blue LED will flash.
2. Open the EasySense2 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 4 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 60 mins 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 C) 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 EasySense2 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 EasySense2 app, the sensor will have to be reconnected after performing the update.

Usage Information

- Make sure the microphone end is placed so it points directly at the sound source.
- When using a 'Value Rises Above' or Higher than' condition to start logging it can be frustrating if classroom noise triggers a recording. It is often best to choose a higher trigger value than planned with a pre-trigger time set so the start of an event is captured.
- This sensor is not waterproof, it has an operating range of 0 to 95% RH (non-condensing). Do not place the sensor in an environment in which high humidity levels are possible as this may result in damage or malfunction.
- If the sensor has been left in the cold, let it warm to near room temperature before waking it from sleep.

Sound level (dBA and dBC ranges)

The unit of sound intensity level or loudness is the decibel (dB). The sensor can measure the sound level in decibels using either the dBA or dBC range. The term dBA and dBC refer to the types of filters used to measure the sound (dB) - either an A filter or a C filter.

The dBA range is the range most widely used as it indicates sound pressure level with 'A' weighting to give a response similar to the normal human ear in the range and intensity that it 'hears' sounds, so a noise which sounds louder will produce a larger dBA reading.

The response of the human ear to levels of loudness will vary with the frequency of the sound wave it is detecting (frequency = sound vibrations produced per second). They are very sensitive in the frequency range of approximately 500 to 6,000 Hz (mid-range frequencies) and much less sensitive to higher and lower frequencies. The A weighing filter covers the full range of human hearing (high and low frequencies sensitivity is reduced).

The dBC range is similar to A but it can also measure sounds whose frequency is outside the range of normal human hearing particularly those sounds with very high (10,000 Hz +) or very low (<800 Hz) sound pressure/frequency levels. The 'C' weighting is useful for measuring high level noise such as engines and machinery.

The loudness of a sound depends on the amplitude of the sound waves. Increasing the 'volume' of a radio increases the amplitudes of the sound waves produced by the radios speaker, so the sound from the radio is louder.

Changing the loudness does not alter the frequency of a sound.

Sound Level (dB)	Perceived loudness at frequency of 1,000 Hz
Above 120	Threshold of pain
100	Very noisy (Rock concert, Helicopter)
80 to 90	Loud (Hair dryer, Lawnmower, medium truck). This is the level at which employers must provide hearing protection
70	Moderate (passenger car)
60	Moderately to quiet (Normal conversation)
40	Very soft (Light rain, Quiet living room)
30	Faint (library)
0	Threshold of hearing

Waveform ranges (mV)

The Waveform range has a maximum frequency response between 20 to 10,000 Hz (10 kHz), its sensitivity then reduces for sound with a frequency between 10 kHz to 16 kHz. It is used for examining the frequency content of sound.

Sound waves are longitudinal. As sound passes through the air, the air particles oscillate about fixed

points from left to right and the energy is also transferred from left to right. It's these vibrating air molecules that cause the human eardrum to vibrate, which the brain interprets as sound.

The amplitude of a wave is the maximum displacement of a particle from rest. The louder the sound, the larger the amplitude wave.

Wavelength is defined as the distance between two successive particles that are at exactly the same point in their paths and are moving in the same direction (same phase). It is given the symbol   and is measured in metres.

The frequency of a wave is the number of complete cycles or oscillations of disturbance each second. The SI unit of frequency is Hertz (Hz).

Pitch depends on the frequency of the sound waves. Making the pitch higher increases the frequency.Different musical instruments playing the same note can produce different waveforms.

Conversion to Pascals

Sound pressure is the difference between the instantaneous pressure at a point in the presence of a sound wave and the ambient atmospheric pressure. The SI unit of sound pressure is the pascal (Pa).

To find the value of the pressure wave that caused the sound (approx.), record data using the mV (or the amplitude) range. Find the maximum amplitude and divide this by 7.9433 to convert to pascals (Pa).

Practical Investigations

The Smart Wireless Sound Level Sensor can be used to investigate a number of scientific experiments such as:

- Animal Activity Studies
- Field Studies
- Road Safety
- Ear Design
- Noise Pollution
- Sound Insulation
- Sound Decay
- Sound Frequency
  - Tuning forks with 3 different frequencies 192 (green line), 256 (red line) and 512 (blue line) recorded with a 50 µs interval for 20 ms with the Y axis set to the Min to Max scale.
- Investigating waves, superposition and Fourier transforms
- Interference in sound waves
- Amplitude and Frequency
- Speed of Sound by measuring a reflected pulse
  - Please note: It is not possible to conduct Speed of Sound experiments that measure sound travelling from one Sound sensor to another Sound sensor. If two Bluetooth or USB connections are made the maximum number of samples per second reduces to 50 (interval of 20 ms) which is not fast enough to capture this event.
- Air Resonance
- Resonance in a pipe
- Sound Waves: monitoring the effect of altering frequency and amplitude, waveforms of musical instruments, beat patterns
- Voice recognition – the sounding of a single letter using a fast recording time

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 EasySense2 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.

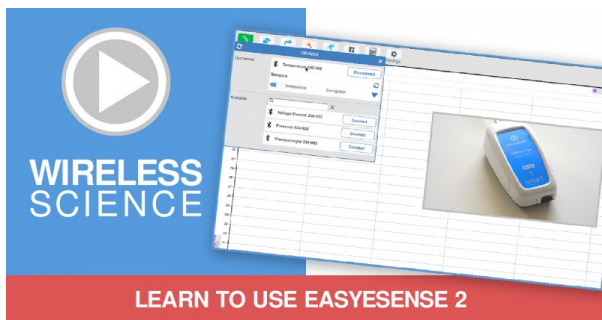See our website for further information and links.

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 EasySense2

The core of our science platform is our EasySense2 software. 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	Sound Level in 2 ranges: (1) 40 to 110 dBA and (2) 40 to 110 dBC Sound Waveform in 2 ranges: (1) ±25 mV, (2) ±100 mV.
Accuracy	±3 dB
Resolution	0.1 dBA/dBC, 0.01 - 0.1 mV
Microphones frequency response	20 to 16,000 Hz (16 kHz), with maximum relative frequency response between 20 to 10 kHz, and reduced sensitivity between 10 to 16 kHz
Fastest logging speed	20,000 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
Internal Battery	Rechargeable internal lithium-ion 3.7 V, 1300 mAh Power specification: 5 V at 500 mA
Storage/Operating Temperature	0 - 40 C
Humidity	0 to 95% RH (non-condensing)
Physical Specifications	Weight: approx. 77 g External dimensions: approx. height 33 mm x width 50 mm x length 90 mm

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 return form 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.

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 2 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 2 app.
2. When the sensor is connected to a computer, the computer should be turned on and not in sleep or standby mode or 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. The sensor is not waterproof.
5. 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
- Twitter
- 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.