

1148 - Wireless Atmospheric Pressure Sensor

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Introduction

Thank you for purchasing the Smart Wireless Atmospheric Pressure Sensor. 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 sensor, please read this documentation in full before contacting the Data Harvest Support Team.



Overview

This Atmospheric Pressure Sensor is USB and Bluetooth compatible. Using Bluetooth, this sensor can connect to mobile devices, tablets, laptops, and desktops.

The Atmospheric Pressure Sensor reports the atmospheric pressure. The pressure range is 30 to 110 kPa, atmospheric pressure has a global average of 101.3 kPa at sea level.

The sensor will also measure elevation to within 0.15 m (based on atmospheric pressure) and temperature to a tolerance of 0.1°C.

This device forms a central component in general atmospheric studies and can be part of a configurable weather station.

The Atmospheric Pressure Sensor is equipped with a micro controller that greatly improves the accuracy, precision, and consistency of readings. It is supplied calibrated, and the relevant stored calibration (for elevation) is automatically loaded when the sensor is connected.

Pack Contents

This product is supplied with the following items:

- [1 x Wireless Atmospheric Pressure Sensor](#)
- 1 x USB Connecting Lead

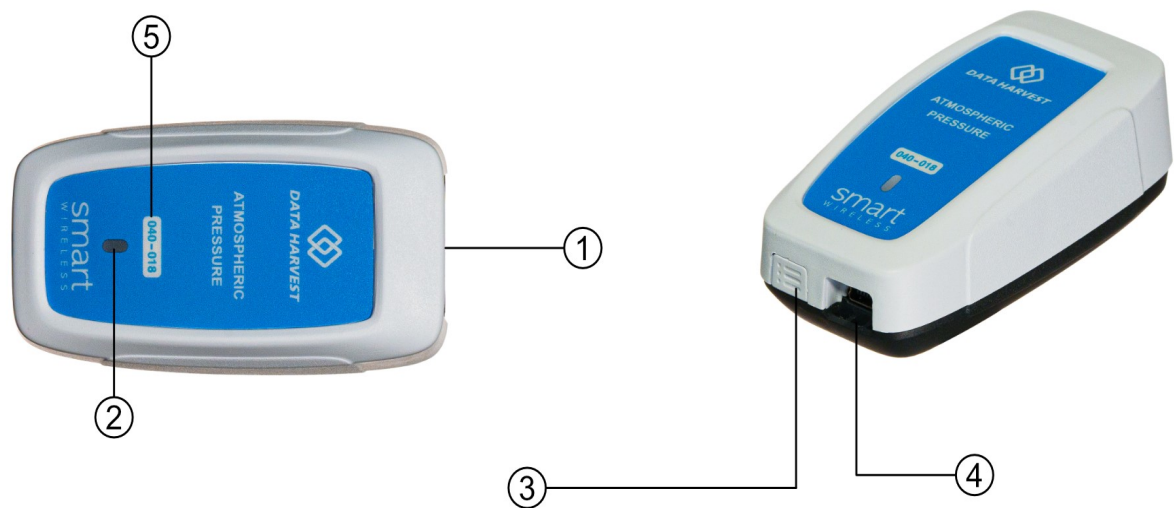
Additional Accessories

To get the most from your Smart Absolute Gas Pressure Sensor, the following items should be considered:

- [Wireless Humidity Sensor](#)
 - [Anemometer](#)
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Operational Overview

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






- 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.

Status Indicator (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) has been established
Solid Green		Fully charged
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 it is 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 it is being used with and the EasySense App 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 EasySense app, so that you can identify each sensor when making a connection wirelessly.

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 computer, 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 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, the LED will flash green.
 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 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.

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 2 mins when Bluetooth advertising (LED status flashing green).

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.

Usage Information

This Wireless Atmospheric Pressure Sensor is designed to report atmospheric pressure.

There are additional facilities with this sensor, to allow the calculation of altitude and consequently sea level pressure from an observation position. The device can evaluate altitude, calculated from a defined baseline and utilising an internal calibration table. Temperature is also available for recording, from this single integrated sensor unit.

The sensor is a compact rugged device for logging key changes in atmospheric pressure patterns. A comprehensive "meteorological station" may be produced with additional wind flow and humidity data logging. It is a very versatile device for helping to understand both complex meteorological behaviour and some of the fundamental laws that govern gas behaviour.

Pressure Measurements

When discussing pressure, we need to make a distinction between absolute pressure and atmospheric pressure.

Empty space has zero pressure and is therefore a reference point for absolute pressure: this is the force per unit area exerted in a defined region with respect to a vacuum. Absolute pressure is uncorrected for any local conditions. The standard way to refer to this quantity is P_{abs} . If the total force F is distributed over a defined area A , then:

$$P_{abs} = F/A$$

Atmospheric pressure is the force per unit area, acting on a defined surface as the result of the column of air above it and may be referred to as P_{atm} . If the average density of air, ρ , the height of the air column present, h , acceleration due to gravity g , are known then:

$$P_{atm} = \rho gh$$

NOTE: Pressure drops, by observation, 1.2 kPa for every 100 m above sea level (approximately 1.1%) when values of h are less than 2000 m.

The atmospheric density is influenced by several factors. For example, temperature and higher humidity tends to lower the density. Since atmospheric pressure is caused by the gravitation pull of the Earth, g , the pressure at altitude, P_h , does not remain constant. It is influenced by the gas composition, the exact radial position of the measurement, temperature, wind and rotational effects due to the Earth's spin.

In a gravitational field, the essential differential pressure expression for a static fluid, with respect to elevation (h) is given by:

$$dP_h/dh = - \rho g$$

The form of pressure distribution that will result, with a molar mass of dry air, m , absolute temperature, T , and Universal Gas Constant R , can be calculated. Assigning P_{atm} to be the atmospheric pressure at "sea level", we can arrive at the pressure at altitude P_h :

$$P_h = P_{\text{atm}} \exp[-mgh/(RT)]$$

This approximates to the following expression, when values of h constrained so that the exponential term < 0.1 :

$$P_h = P_{\text{atm}} [1-mgh/(RT)]$$

or

$$P_h = P_{\text{atm}} \{1-mgh/[(C_p-C_v)T]\}$$

The constants C_p and C_v are the specific heat capacity values at constant pressure and volume respectively.

This predicts a 1% drop in pressure for every 100 m displacement from sea level below 2000 m.

Pressure Temperature and Altitude

To compare pressure conditions around the world, meteorologists adjust the measured pressure to sea-level conditions - called relative pressure. Air pressure decreases with altitude; the relative pressure at a location is higher than the measured pressure, as it has been corrected to the sea level equivalence. Relative pressure is larger than measured atmospheric pressure - unless one measures below sea-level (see below).

All three of the measurement types available in this sensor can be linked together in a single relationship that is represented by the following equation. Setting P_0 to be the atmospheric pressure at sea level, T the temperature in Celsius and h to be the displacement between the measurement and P_0 and P_h , then:

$$P_0 = P_h [1 - 0.0065 \times h / (T + 0.0065 \times h + 273.15)]^{-5.257}$$

The above relationship forecasts a pressure drop of approximately 1% for every 100 m elevation, at 15 Celsius, below 2000 m.

All of the Atmospheric Pressure Sensor's collection data can be gathered using the EasySense App. Temperature can be measured to 0.1 °C precision, altitude to within 0.14m and atmospheric pressure to within 0.01 kPa.

Altitude is calculated with respect to a reference pressure (at sea level), notionally 101.325 kPa. If differential altitude values are required not so referenced, then see below (EasySense) to produce a more convenient output.

Measurement in EasySense

The Atmospheric Pressure Sensor is designed to be used with EasySense software, available from the Data Harvest website. The sensor may be used in the following way.

1. Turn on the sensor.
2. Connect the sensor to the EasySense app, using the Devices Icon.
3. Select the measurement types that you need and close the Devices panel.
4. Select, from Setup, either Continuous or Snapshot mode - depending on the type of experiment to be conducted. Time-based measurements utilise the Continuous mode, while singular evaluation makes use of the Snapshot mode.

5. Use the "Set Tare" facility, available from the "Live Data" panel, if relative altitude reporting is required.
6. Data may be exported to other packages for further analysis as required.

Advice for Correct Usage

- Please observe the operational limits for the sensor.
- This Atmospheric Sensor measures absolute atmospheric pressure. The sensor end cap needs to be open to the atmosphere.
- It is not intended for use as a universal gas pressure monitor.
- Any protective container used (for meteorology) must be suitable for the task and able to sustain the free air flow conditions.
- Protect from the weather – keep the sensor dry and free of condensation.
- Do not place the sensor in an environment in which there are very high long - term humidity levels. This may result in damage or malfunction.
- It may be cleaned using a soft moist cloth.
- Do not immerse in water or detergent.
- Do not expose to chemical vapours such as acetone, organic solvents, or chlorine.

Units of Measurement and Definitions

Pressure is defined as force per unit area and the standard SI unit of pressure is the pascal (Pa) - 1 Pascal = 1 Newton per square meter (1 N/m^2).

The average pressure exerted at sea level by the atmosphere is 101.325 kPa (1 atmosphere).

One atmosphere is also 760 mm or 29.9 inches of Hg. The conversion from kPa to mbar is simply to multiply by 10 ($1 \text{ kPa} = 10 \text{ mbar} = 0.14504 \text{ psi}$).

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.

Practical Investigations

The advantage of this sensor over a standard pressure gauge is additional sensors for recording elevation and temperature. Pressure, temperature, and altitude may be recorded via software: that data may be subsequently displayed and analysed easily for events, as analysis methodology evolves.

Examples of practical work where use of the sensor will enhance learning and understanding include work to study:

- The changes in atmospheric pressure with altitude
- As part of a weather station - to record changes in local weather conditions with time
- Monitoring an active storm front's development
- As an altitude recorder: Linked to GPS, to give profile data for a journey (such as a hike)
- In physical chemistry and physics, to estimate the Universal Gas Constant, R , from a pressure altitude distribution
- In the physical sciences to understand pressure, the effects of gravity, and how fluids behave in a gravitational field

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.

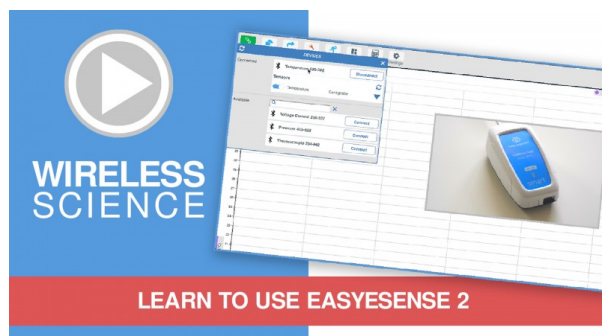
See our website for further information and links.



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	Atmospheric pressure: 30 kPa to 110 kPa Elevation 15 m absolute position to limits of pressure Operating Temperature: -40 to 85 °C
Resolution	Atmospheric pressure: 0.01 kPa Elevation: 0.14 m Temperature: 0.1 °C
Fastest logging speed	100 ms
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
Storage/Operating Temperature	0 - 40 C
Humidity	0 to 95% RH (non-condensing)
Internal Battery	Rechargeable internal lithium-ion 3.7 V Power specification: 5 V at 500 mA
Physical Specifications	Weight: approx. 80 g External dimensions: approx. height 33 mm x width 50 mm x length 98 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

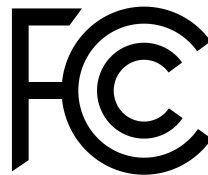
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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.

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

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 maximum pressure that this sensor can tolerate without permanent damage is 1600 kPa.
 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.
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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.
