1150 - Wireless Absolute Gas Pressure Sensor

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Introduction

Thank you for purchasing the Smart Wireless Absolute Gas 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

The Smart Wireless Absolute Gas Pressure Sensor is USB and Bluetooth compatible. Using Bluetooth, a sensor can connect to mobile devices, tablets, laptops and desktops.

The Absolute Gas Pressure Sensor has a single measurement port that measures the total pressure on a system relative to a calibrated absolute zero pressure. When the single port is left open, the sensor will measure atmospheric pressure. For example, if a syringe (for Boyles law practical) is connected to the sensor, and the plunger pushed to give a reading of 300 kPa, it means that the measured pressure is 300 kPa, not that we have added 300 kPa of pressure. The range is 0 to 400 kPascals (kPa), atmospheric pressure is global average of 101.3 kPa at sea level.

The sensing element of the Gas Pressure Sensor is piezoresistive: when a stress or strain is applied to the sensor, it changes the resistance to the flow of current. The change in resistance is proportional to the stress, and the stress is created by the pressure acting on the sensor. The sensor's electronics have temperature compensation to minimise the effect of ambient temperature changes to the sensor and electronics.

The connector on the Gas Pressure Sensor is a female Luer lock (screw) type open-flow style. If a shut off is required, a tap will need to be fitted. Data Harvest have a kit of valves, adapters, tubing etc, which is in the Gas Pressure Accessory Kit (1149).

The female hub has a half turn lock into threads on a male Luer fitting. Luer lock couplings are a standardised system for making leak-free connections between two fittings e.g. female to male fitting. The female connector on the sensor is made for nylon and will become slack with repeated use and overtightening. We recommend the use of one of the male connectors supplied, and length of tubing to take

the use away from the connector to a user replaceable connection.

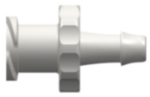
Pack Contents

This product is supplied with the following items:

- 1 x Wireless Absolute Gas Pressure Sensor
- 1 x USB Connecting Lead
- 100 mm of silicon tubing
- 2 x male and 1 x female Luer connectors

Male Luer nylon lock ring to barb connector, to fit 3 mm (1/8”) ID tubing

Female Luer nylon thread style to barb connector, to fit 3 mm (1/8”) ID tubing



Additional Accessories

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

- Wireless Differential Gas Pressure 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.

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 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, 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 it is being used with and the EasySense 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 EasySense app, so that you can identify each sensor when making a connection wirelessly.

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

This Pressure sensor is used to measure absolute pressure - the actual gas pressure at the port with respect to zero.

The pressure is measured against a built-in internal vacuum reference. The sensor then produces an output voltage that varies with absolute pressure.

The sensor measures accurately between 20 to 400 kPa linearly.

Values below 20 kPa are slightly non-linear and may be not so reliable.

If the port is left open to the atmosphere, the sensor will display the value for atmospheric pressure, also known as barometric pressure, which is pressure caused by the downward force of the Earth's gravity pressing the air down on the Earth.

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

- This Pressure sensor measures absolute pressure - the actual gas pressure at the port with respect to a built-in internal vacuum reference.
- The sensor then produces an output voltage that varies with absolute pressure.
- The sensor measures accurately between 20 to 400 kPa in a linear fashion.
- Values below 20 kPa are slightly non-linear and may be not so reliable.
- If the port is left open to the atmosphere, the sensor will display the value for atmospheric pressure, also known as barometric pressure, which is pressure caused by the downward force of the Earth's gravity pressing the air down on the Earth.
- The average pressure exerted at sea level by the atmosphere in Britain is 101.325 kPa (1 atmosphere).
- The barb on the Luer connectors supplied with the Gas Pressure sensors will fit PVC or Silicon tubing with an internal diameter of 3 mm (1/8").
- A Gas Pressure Accessory Kit, Product No.1149, is available which contains a selection of tubing elements and connectors which allow gas tight connections to these Gas Pressure sensors. Only use these sensors to measure non-corrosive/non-ionic media such as air or dry gases.
- This sensor is not suitable for use with flammable gases.
- A small amount of lubricant on tubing and connectors will make the tubing slide on more easily.
- The vapour pressure of liquids can be monitored but do not allow liquid to enter the sensor.
- Protect from the weather – keep the sensor dry.
- The container used with the Pressure sensor must be suitable for the task and able to sustain the pressure. The type of container selected will depend on the investigation.
- A non-flexible airtight container like a syringe could be used for quantitative investigations e.g. pressure vs. volume.
- Gas contained in a system under pressure will try to find a way out. The longer the investigation lasts, the more dominant the effect of any leaks will become - try to complete the investigation as quickly as it allows.
- The sensor is not waterproof. It may be cleaned using a damp cloth. Do not immerse in water or detergent. Do not place the sensor in an environment in which high humidity levels are possible as this may result in damage or malfunction.

Units of Measurement

Pressure is defined as force per unit area and the standard SI unit of pressure is the pascal (Pa).

The conversion from kPa to mBar is simply to multiply by 10. (1 kPascal = 10 millibar = 0.14504 psi).

1 Pascal = 1 Newton per square meter (1 N/m^2).

Equivalent values for 1 atmosphere are = 101.325 kPa = 760 mmHg = 29.92 in. of Hg (at 0ºC) = 14.70 PSI = 1013 millibar.

Practical Investigations

The Smart Wireless Absolute Gas Pressure sensor can be used wherever you would use a pressure gauge. The advantage of use over a standard gauge will be the ability to use many sensors (for example pressure and temperature), record the data via software, display the data to a large numeric display, and record fast transient events. Examples of practical work where use of the sensor will enhance learning and understanding include work to study:

- Boyle's law
- Gay-Lussac's law – estimation of absolute zero
- Charles law.
- Study of the relationship between temperature, pressure and volume (ideal gas laws)
- Rate of chemical reaction
- Production of gases in enclosed atmosphere
- Depth gauge
- Changes in air pressure - barometer

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	400 kPa
Fastest logging speed	40,000 samples per second [25 µs]
Maximum burst pressure. Above this and the sensor will be damaged.	1600 kPa
Temperature compensated	Between -40 to 125˚C
Maximum error	1.5% over 0 to 85˚C
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 to 40℃
Humidity	0 to 95% RH (non-condensing)
Internal Battery	Rechargeable internal lithium-ion 3.7 V
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 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 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.

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.
