



1130 - Wireless 20V Voltage & Current Sensor

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Introduction

Thank you for purchasing the Smart Wireless 20V Voltage & Current 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 Voltage and Current sensors are USB and Bluetooth compatible. Using Bluetooth, a sensor can connect to mobile devices, tablets, laptops and desktops.

The Voltage and Current sensor is a combined sensor. It can measure both electric current and the potential difference across a component in low voltage a.c. or d.c. circuits, or be used as a voltage or current sensor. Software and firmware will allow the user to show resistance and power values directly from the sensor, or as derived functions from the calculate function in the software.

Any number and combination of Voltage and Current sensors can be added into a circuit. The wireless Voltage and Current sensor is not compatible with the SmartQ Voltage and SmartQ Current sensors.

SAFETY: Never use high voltages or household a.c.

The four 4 mm sockets (2 for Voltage and 2 for Current) allow for connection to most standard available electronics kits and school based power supplies using 4 mm plug leads (not supplied).

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 Wireless 20V Voltage & Current Sensor](#)
- 1 x USB Connecting Lead

Additional Accessories

To get the most from your Smart Wireless Voltage & Current Sensor, the following items should be considered:

- [Wireless 5V Voltage & Current Sensor](#)
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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.
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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

CAUTION: Never connect a Current sensor directly across a battery or power supply without a resistance component to limit the current to within the range of the sensor. Failure to limit the current will cause permanent damage to the sensor.

- If the Voltage sensor is not part of a complete circuit, then data collected may appear 'noisy'. To measure voltage accurately you need an impedance (resistance); the Voltage sensor is a high impedance device and will pick up any electrical 'noise'.
- Note: To demonstrate zero impedance, short out a Voltage sensor by connecting its black & red plugs together.
- A tare function is present in the software to set the zero of current and/ or voltage.
- The Current sensor has a very low resistance, so it will introduce as little resistance as possible to the circuit.
- For some work, the d.c. output from a chemical cell will give the best results, for example, discharge and charge constants of a capacitor resistance circuit.
- An alternative to batteries is to use a fully isolated mains power supply with a regulated d.c. output (smoothed and fully rectified).
- Be aware that some power supplies are 1/2 wave rectified producing an average rather than true d.c. The sensors will 'pick up' the fluctuations in voltage and current from this type of power supply. The Voltage and Current sensor does not smooth the data, as you would see in a multimeter, and will return the value that is present at the sample period. Without smoothing you can record at very short intersample periods (50 μ s or 50,000 Hertz).

The suitability of components can be checked using Ohms law.

The Current sensor is protected to a voltage of ± 13 V. The maximum working voltage of the Current sensor before damage is ± 13 V.

For example: A 100 Ω 3 W resistor gives good results without too much heat.

- ⊙ 6 V supply with 10 Ω resistor = 0.6 A (600 mA) current flow (Power 0.6 x 6 = 3.6 W).
 - ⊙ 6 V supply with 50 Ω resistor = 0.12 A (120 mA) current flow (Power 0.12 x 6 = 0.72W).
 - ⊙ 6 V supply with 100 Ω resistor = 0.06 A (60 mA) current flow (Power 0.06 x 6 = 0.36W).
 - The Current sensor is protected to a voltage of ± 13 V, The maximum working voltage of the Current sensor before damage is ± 13 V.
 - The operating range of the sensor is 0 to 40 C and 0 to 95% RH (non-condensing). Do not subject to extreme heat or cold. Do not expose to direct sunlight for extended periods of time.
 - 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.
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Practical Investigations

The Smart Wireless 20V Voltage & Current Sensor can be used wherever you would use a voltmeter or ammeter. The advantage of using these sensors over multimeters will be the ability to use many sensors, record the data via software, and record fast transient events. Examples of practical work where use of the sensor will enhance learning and understanding include work to study:

- What changes the current in a circuit?
- Series and parallel circuits
- Ohm's law
- Good and bad conductors
- Alternative power investigations e.g. solar cells, water power, wind energy, etc
- Fuses
- Laws of resistance
- Long wires, less power?
- Electrical component characteristics
- Dynamo effect
- Start-up current of a lamp
- Faraday's induction of current or voltage in a coil
- Capacitor discharge, charge and energy stored
- Diodes: a.c.. diode rectification
- Specific heat capacity for a liquid or solid
- Calibration of a thermometer
- Impedance change with frequency
- Efficiency of an electric motor / generator
- Resonance in a series LCR circuit
- Reactance and phase in a capacitor

With the software set to a numeric display the sensor and software will create a digital voltmeter and ammeter.

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	± 1000 mA, ± 20 V
Maximums	Maximum voltage on Voltage channel: ± 22 V Maximum current on Current channel: ± 5 A Maximum voltage on Current channel: ± 13 V
Resolution	1 mV, 1 mA
Current Sense Resistance	0.1
Voltage Input Impedance	> 2M
Fastest logging speed	20,000 samples per second (interval 50 μ s)
Power specifications:	5 V at 500 mA
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, 1300 mAh Power specification: 5 V at 500 mA
Physical Specifications	Weight: approx. 82 g External dimensions: approx. height 33 mm x width 50 mm x length 92 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

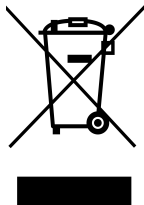
Data Harvest Group Ltd is fully compliant with WEEE legislation and is pleased to provide a disposal service for any of our products when their life expires. Simply return them to us clearly identified as 'life expired' and we will dispose of them for you.

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	<p>If the sensor loses Bluetooth connection and will not reconnect try:</p> <p>Closing and reopening the EasySense 2 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 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.
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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.
