1102 - Wireless Thermocouple Sensor

Revision: 2.0 | DS160

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Introduction

Thank you for purchasing the Smart Wireless Thermocouple 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.
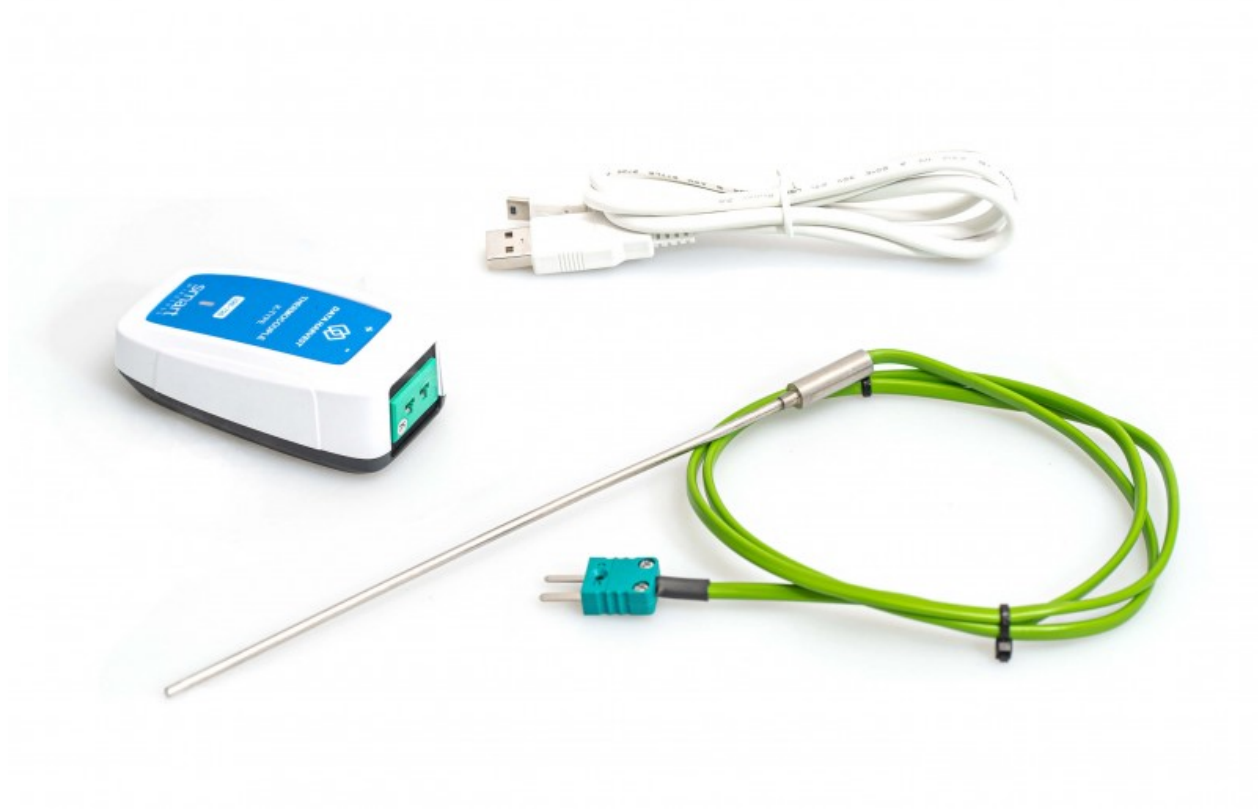
Overview

The Smart Wireless Thermocouple sensors are USB and Bluetooth (4.x and higher) compatible. Using Bluetooth, a sensor can connect to mobile devices, tablets, laptops, and desktops.

The K-type Thermocouple used in this sensor gives a range of -200 to 1200°C with 0.1°C degree accuracy over the entire range.

The wide temperature range of this sensor enables it to be used in a variety of experiments e.g. melting points and flame profiles, and in work that requires good accuracy, for example estimate of absolute zero. The K-type thermocouple is replaceable and connects by a keyed connection, the junction of which is housed at the end of a stainless-steel sheath.

The plastic sheath that covers the wiring taking the signal from the thermocouple to the adaptor is not heat resistant.

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 Thermocouple Adaptor
- 1 x K-Type Thermocouple
- 1 x USB Connecting Lead

Additional Accessories

To get the most from your Smart Thermocouple Sensor, the following items should be considered:
- Wireless Temperature Sensor
- Wireless Infra-Red 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.
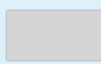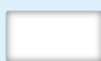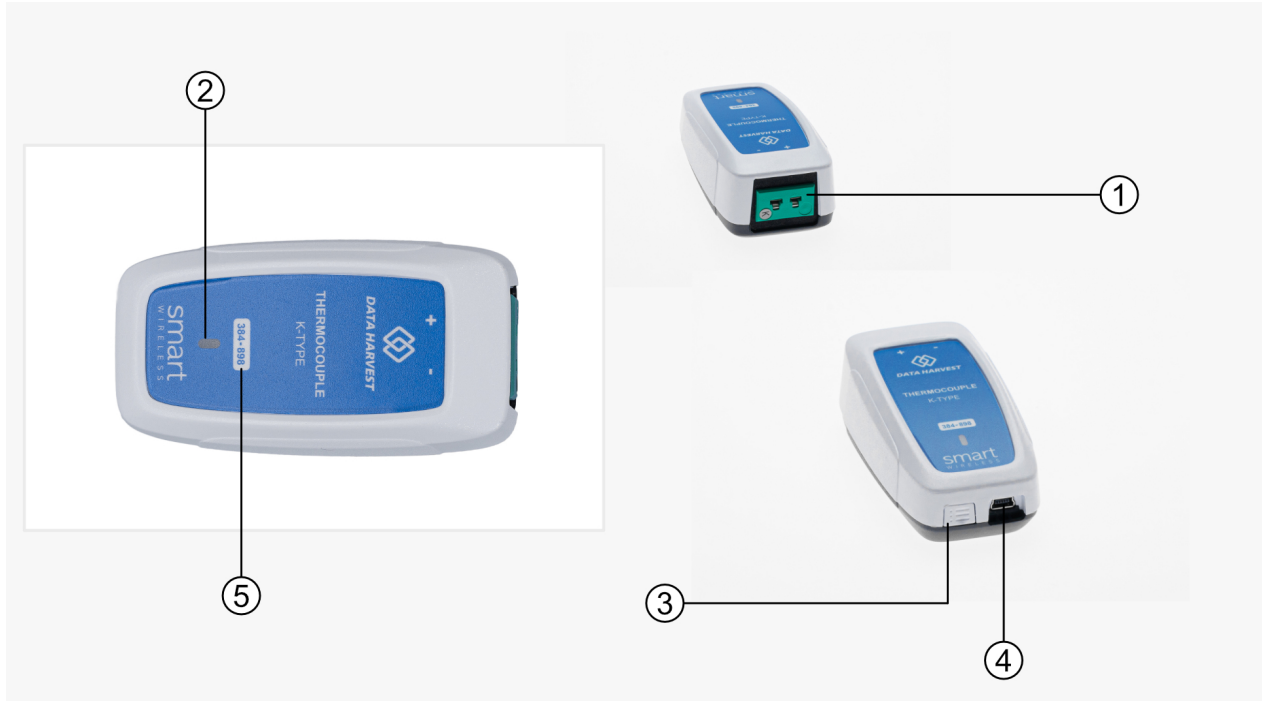

1. Sensor End Cap
2. Status Indicator
3. On/Off Switch
4. USB Port
5. Unique ID Number

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 C) and state-of-charge.

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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 'Type K' thermocouple

The thermocouple junction is housed at the end of the 200 x 3 mm AISI 310 stainless steel sheath (also known as Chromium Nickel Steel). It has a one-metre-long cable that terminates in a mini plug colour coded green to indicate thermocouple 'type K' (the International IEC colour code for K Type thermocouples is green).

Theory

The simplest thermocouple has two wires made of different metal alloys (nickel chromium (+) and nickel aluminium (-) in type K). When the ends of these two different wires are connected or twisted together, if one end is heated or cooled while the other end remains at a constant temperature, a small potential or voltage is created. This small voltage difference is called the Seebeck Effect; it is amplified and used as a way of measuring temperature difference.

Further information

- The Thermocouple sensor can use any industry standard 'K type' thermocouple. Limit the working range to that of the thermocouple attached e.g. a welded tip PTFE insulated 'K' type thermocouple may have an operating range of only –50 C to 200 C.
- The old colour codes for thermocouples were phased out and replaced with a new specification code, IEC 5843 (for international use). The IEC colour code at present for a 'K' type thermocouple is green.
- The metal sheath of the type K thermocouple can withstand temperatures up to 1,200 C, however the PVC insulation on the connecting cable has a working range of -30 C to 90 C, so keep this cable away from the source of heat e.g. by clamping the Sensor in position. The metal sheath is filled with a silica compound to keep the junction away from the walls of the sheath.
- Stainless steel 310 (Chromium Nickel Steel) was selected as the material for the sheath for its properties as a poor conductor; heat should not transfer along the full length of the sheath as long as it is not insulated.
- The thermocouple junction is insulated from the stainless-steel sheath. If non-insulated thermocouples are used, they must be insulated from each other, or incorrect readings will result.
- The sensor's microchip converts thermocouple EMF to degree Celsius with integrated cold - junction compensation using temperature correction coefficients derived from the National Institute of Standards and Technology thermocouple database.
- Carbon deposits are best wiped off using a dry cloth.
- The adaptor body is not waterproof. It may be cleaned using a damp cloth. Do not immerse in water or detergent. Do not place the adaptor in an environment in which high humidity levels are possible as this may result in damage or malfunction.
- When working from high to lower temperatures, allow the Sensor time to cool and stabilize before taking a new reading.

SAFETY:

If the metal rod of the thermocouple is very hot, allow it to cool in air for while before plunging into cold water.
Allow the thermocouple rod time to cool before handling.
Follow health & safety procedures if working with extremely hot or cold objects.

Conditions to avoid:
- Do not put the sensor housing part into liquids, chemicals, ovens, or fire at any time.
- Do not let the flame from a Bunsen, candle, or similar make contact with the thermocouple's PVC insulation. Only the tip of the metal thermocouple probe should be in contact with the flame.
- Do not place the sensor housing part inside a freezer, only thermocouple probe portion should be placed

in the freezer.

Practical Investigations

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

- Discovering how the temperature inside a Bunsen flame varies.
- Comparing the temperature at which different candles burn (test out variables and whether they affect temperature e.g. colour, diameter of candle, scented vs. unscented)
- Which part of a candle flame is hottest?
- Investigating whether the variety of wax used to make a candle affects the rate of combustion and luminosity
- Discovering at what temperature popcorn pops – evaluating poppers and varieties of popping corn
- Using melting point to Identify a solid e.g. bismuth, aluminium, zinc, tin, lead, etc. The solids known melting point should be less than 1,200 C.
- Temperature of dry ice or liquid air
- Estimation of absolute zero
- Any temperature investigation that requires high accuracy over the entire range
- The K-Type thermocouple is not suitable for rapid temperature change work

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.
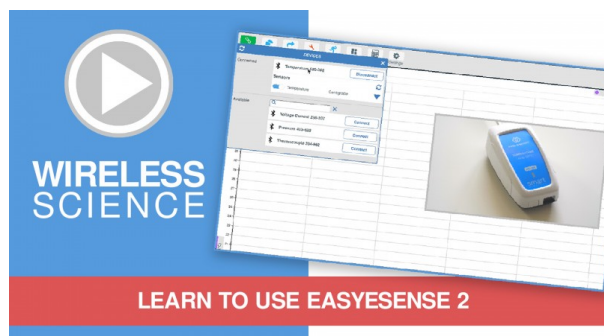
See our website for further information and links.

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	-200 C to 1,200 C
Resolution	0.1 C
Fastest logging speed	2 samples per second [500 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
Internal Battery	Rechargeable internal lithium-ion 3.7 V
Storage/Operating Temperature	0 to 40 C
Humidity	0 to 95% RH (non-condensing)
Physical Specifications	Weight: approx. 115 g External dimensions: approx. height 33 mm x width 50 mm x length 95 mm
K-Type thermocouple:	Tip temperature minimum and maximum working range -200 C to 1200 C Probe PVC insulation range: -30 C to 90 C Length of PVC cable: 100 cm Length of metal rod 200 mm. Diameter of rod 3 mm. Metal element type: Nickel chromium (+) and nickel aluminium (-) K-Type Thermocouple length 1.2m. (PVC cable + Metal rod)

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.
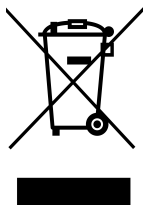
Troubleshooting

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	**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.