Current Sensor

(Product No. 3166)
Range: **±100 mA**
Resolution: 50 µA

Current Sensor

(Product No. 3165)
Range: **±1 A**
Resolution: 0.5 mA

Current Sensor

(Product No. 3167)
Range: **±10 A**
Resolution: 10 mA

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Introduction

The *Smart Q* Current Sensors are used to measure the current flowing in a circuit.
This range of Current Sensors can be used in both DC and low–voltage AC circuits.

! SAFETY: Never use high voltages or household AC

The *Smart Q* Current Sensors are equipped with a micro controller that greatly improves the sensor accuracy, precision and consistency. They are supplied calibrated and the stored calibration (in Amps) is automatically loaded when the Current Sensor is connected.

Connecting

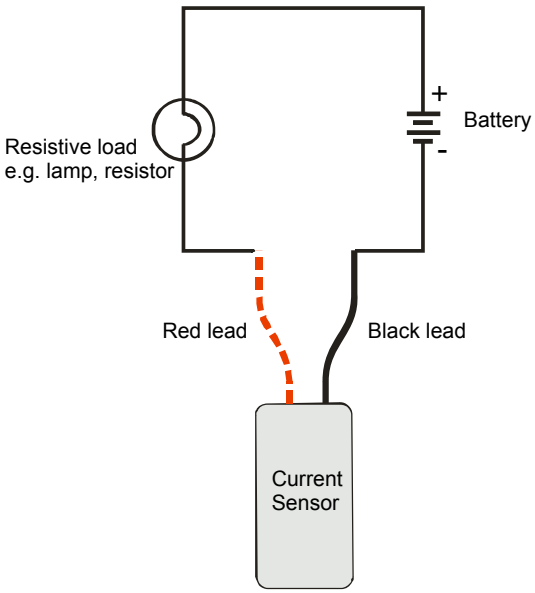
- Push one end of the sensor cable (supplied with the **EASY**SENSE unit) into the hooded socket on the adaptor with the locating arrow on the cable facing upwards.
- Connect the other end of the sensor cable to an input socket on the **EASY**SENSE unit.
- The **EASY**SENSE unit will detect that the Current Sensor is connected and display values.

Practical 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.

Current is the rate of flow of electrical charge past a point per second.

- The Current Sensor should be placed in **series** with the circuit component through which the current is to be measured.
- Make sure you observe the correct polarity i.e. connect the black lead from the Current Sensor to the negative terminal of the cells.
- Currents in either direction can be measured.
- The Current Sensors have a very low resistance so that they introduce as little resistance as possible to the circuit.



- Check the suitability of the components to be used with Ohms law.

  $$\text{Current (I)} = \frac{\text{Voltage (V)}}{\text{Resistance (R)}}$$

Power source	Resistor	Current flow	The Current Sensor most suitable
3 V	100 Ω	0.03 A (30 mA)	3166 (±100 mA)
4.5 V	100 Ω	0.045 A (45 mA)	3166 (±100 mA)
6 V	100 Ω	0.06 A (60 mA)	3166 (±100 mA)
3 V	50 Ω	0.06 A (60 mA)	3166 (±100 mA)
4.5 V	50 Ω	0.09 A (90 mA)	3166 (±100 mA) or 3165 (±1A)
6 V	50 Ω	0.12 A (120 mA)	3165 (±1A)
3 V	10 Ω	0.3 A (300 mA)	3165 (±1A)
4.5 V	10 Ω	0.45 A (450 mA)	3165 (±1A)
6 V	10 Ω	0.6 A (600 mA)	3165 (±1A)

- When large quantities of cells are used in a circuit the current flow can cause low value resistors to become very hot (W = V x A). A 100 Ω 3 W resistor will give good results without too much heat.

  For example:
  - 6 V power with 10 Ω resistor = 0.6 A (600 mA) current flow (Power 0.6 x 6 = 3.6 W).
  - 6 V power with 50 Ω resistor = 0.12 A (120 mA) current flow (Power 0.12 x 6 = 0.72W).
  - 6 V power with 100 Ω resistor = 0.06 A (60 mA) current flow (Power 0.06 x 6 = 0.36W).

- Batteries are the first choice as the source of energy. An alternative to batteries is to use a fully isolated mains power supply with a regulated DC output (smoothed and fully rectified).

  Be aware that some power supplies are ½ wave rectified producing an average rather than true DC. The Current Sensor will 'pick up' the fluctuations in voltage and current from this type of power supply.

Specifications

Product Number	3166	3165	3167
Range	±100 mA	±1 A	±10 A
Resolution	50 µA	0.5 mA	10 mA
Maximum voltage (V)	±27	±27	±27
Resistance/impedance	1R8 (1.8 Ohms)	0R18 (0.18 Ohms)	0R018 (0.018 Ohms)

Subtracting an offset

If you want to subtract an offset from a Sensor's reading (i.e. when the reading isn't exact zero) use the Tare pre or post-log function.

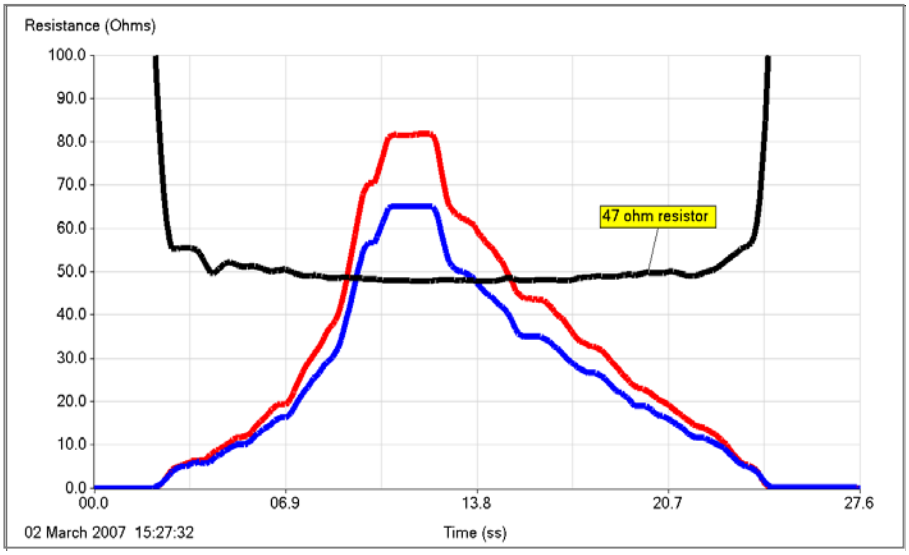
Note: Use the Pre-log function for the tare to be applied to the data as logging progresses or the Post-log function to apply the tare to data that has already been recorded.

- Select **Test Mode** from the **Tools** menu to find the tare value and then click on **Stop**.
- Select **Pre** or **Post-log function** from the **Tools** menu.
- Select a **Preset** function, with **General** from the drop-down list and then **Tare** from the second list, Next. Select the Current Sensor as the Channel, Next. Enter a name for the corrected data set e.g. Current (adj.) and enter the **tare value**. Click on Finish.

Calculating Resistance or Power

A pre or post-log function can be used to calculate Resistance or Power from Current and Voltage data.

- Select **Pre** or **Post-log function** from the **Tools** menu.
- Select a **Preset** function, with **Electricity** from the drop-down list and then **Calculate Resistance** or **Calculate Power** from the second list, Next.
- Select the Voltage and Current channel to use, Next.
- Enter the appropriate multiplier using the information supplied in the white panel. Click on Finish.



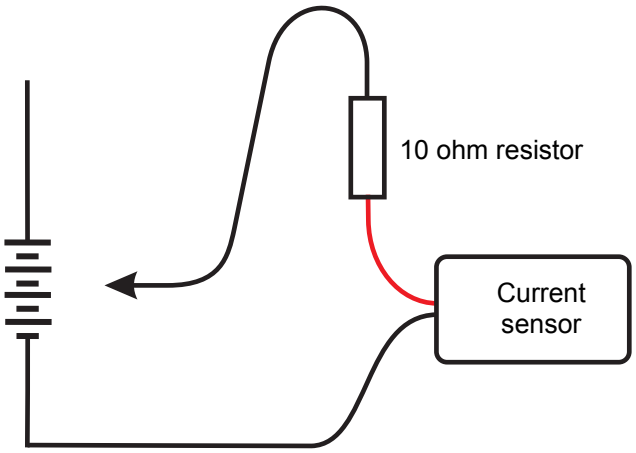
Graph showing the result from an electrical resistance investigation

Investigations

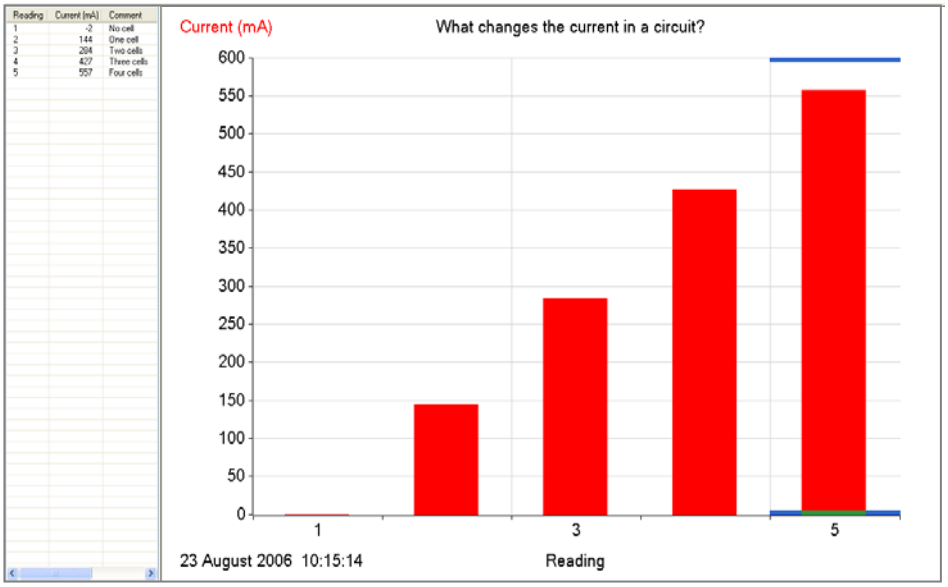
- *Battery life*
- *What changes the current in a circuit?*
- *Good and bad conductors*
- *Can you use bulb brightness to measure current?*
- *Ohm's law*
- *Series and parallel circuits*
- *Voltage / Current relationships*
- *Power*
- *Electrical component characteristics e.g. a light dependent resistor*
- *Start up current of a light bulb*
- *Alternative power investigations e.g. solar cells*
- *Capacitor discharge, charge and energy stored*
- *Heat and electric current*
- *Faraday's induction in a coil, induction of current in a conductor*

What changes the Current in a circuit?

In this investigation the current flowing in a circuit is measured when a different number of electrical cells are connected.



- Assemble the apparatus as shown with the Current Sensor connected to the **EASY**SENSE unit.
- Open the **EASY**SENSE program and select **Snapshot** from the Home screen.
- With no cells (batteries) connected, click on **Start**. Click in the graph area to snap the first reading.
- Double click in the first row of the Comments columns and type ‘No cells’ into the dialogue box, OK.
- Connect one cell into the circuit and take another reading. Type a 'One cell' comment for this sample.
- Repeat with two, three and four cells. Click on **Stop**.

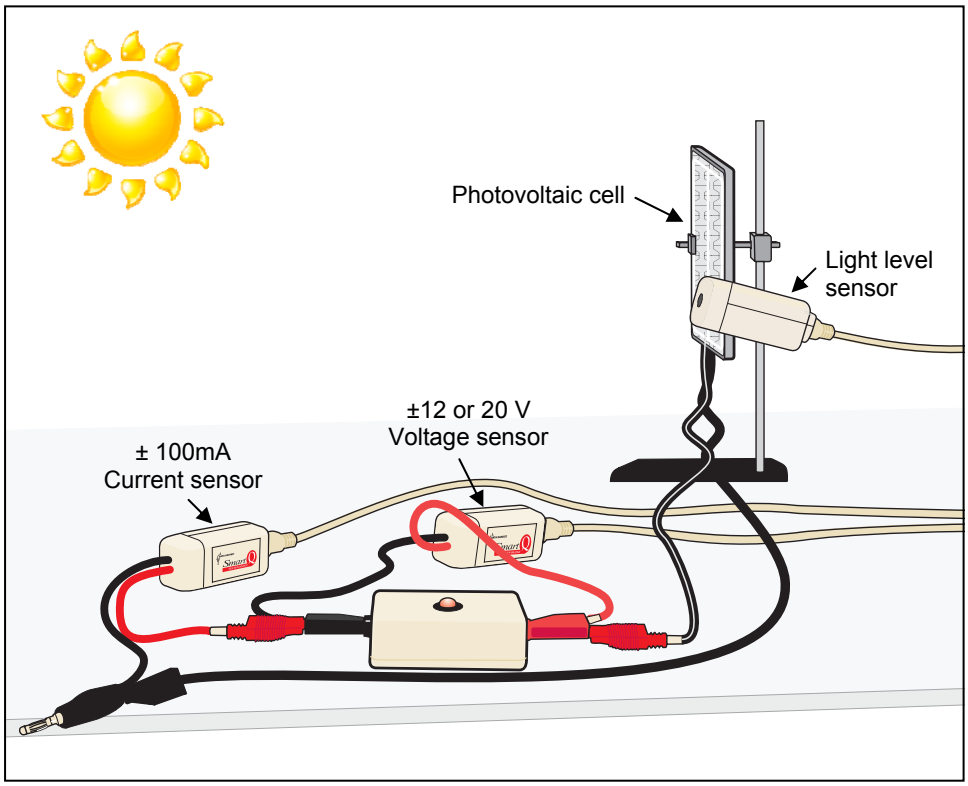


For this example the data has been displayed with the limits of the Current axis altered to 0 – 600 mA (Options, Sensor Settings).

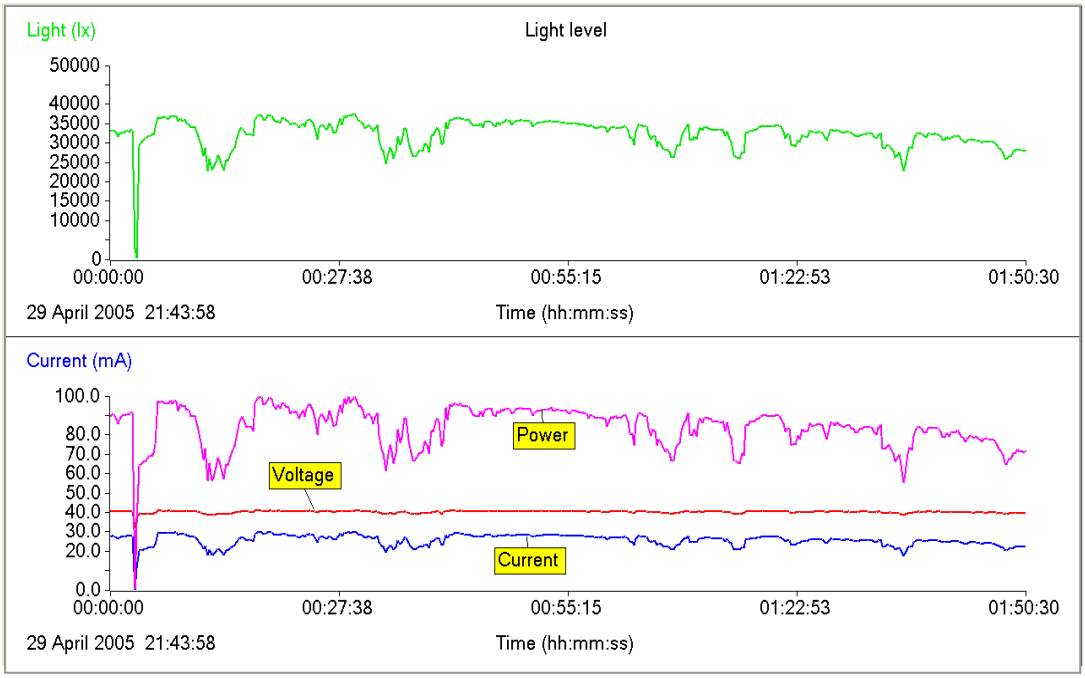
Alternative energy - Solar Cells

A solar panel (photovoltaic cell) has special components that will transfer the sun's energy directly into electrical energy. In this investigation the solar cell from the Alternative Energy pack was used to find out how strong the sun needs to be to produce electricity.

Note: Photovoltaic cells need a load connected across the output to give the true current and voltage.



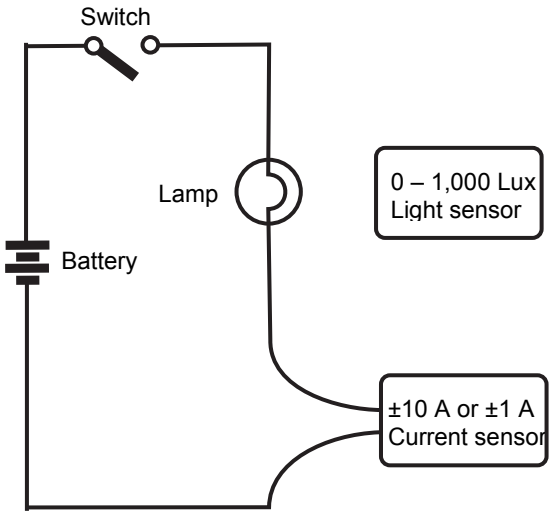
The data is displayed on two graphs with the sensor setting axis limits altered via the Options icon. The Power post log function was used to calculate power from the current and voltage data.



Start up current of a bulb

Note: This investigation is only suitable for an **EASY**SENSE unit capable of fast logging.

1. Open the **EASY**SENSE program and select either **Scope** or **Graph** from the Home page. Set the options for recording the data (see suggestions in the table below).

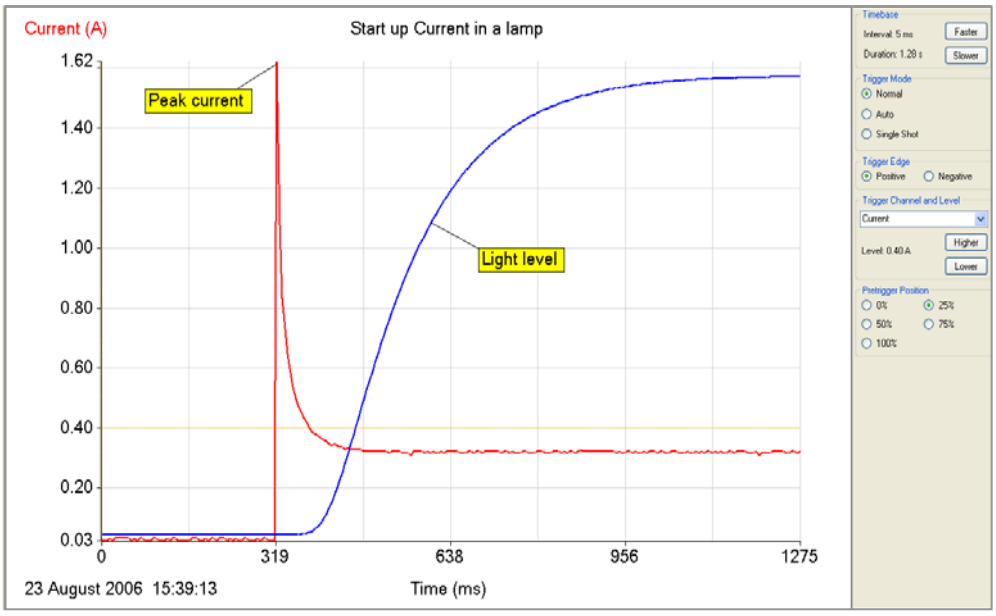


Suggested recording setups

Smart Q Sensor	±1 A Current	±10 A Current
Graph		
Recording times	500 ms, 1 s, 2 s	500 ms, 1 s, 2 s
Intersample times	500 us, 1 ms, 2 ms, 5 ms	500 us, 1 ms, 2 ms, 5 ms
Suggested trigger level	Rises above **40 mA**, 25% pre-trigger	Rises above **0.40 A**, 25% pre-trigger
Scope		
Interval	2 ms, 5 ms, 10 ms	2 ms, 5 ms, 10 ms
Trigger mode	Normal or Single shot	Normal or Single shot
Suggested trigger level	Positive **40 mA** with 25% pre-trigger	Positive **0.40 A** with 25% pre-trigger

2. Close the switch so the lamp lights. Select **Test mode** from the Tools menu and adjust the distance of the Light level sensor from the light bulb (to ensure readings are within range). Open the switch.

3. Click on the **Start** icon to begin. Close the switch to complete the circuit. Open the switch when the recording has finished



A 3 V battery and bulb, with Scope, interval 5 ms, trigger positive when the ±10 A Current sensor rises above 0.40 A with a 25% pre-trigger. 'Autoscale channel 0 to Max' applied to the Current data.

Warranty

All Data Harvest Sensors are warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided they have been used in accordance with any instructions, under normal laboratory conditions. This warranty does not apply if the Sensor has been damaged by accident or misuse.

In the event of a fault developing within the 12 month period, the Sensor must be returned to Data Harvest for repair or replacement at no expense to the user other than postal charges.

Note: Data Harvest products are designed for **educational** use and are not intended for use in industrial, medical or commercial applications.

WEEE (**W**aste **E**lectrical and **E**lectronic **E**quipment) 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.