



Engaging with Science

WORKING WITH YOU TO RAISE STANDARDS

COLLECT • SHOW • EXPLORE • LEARN • ACHIEVE



Contents

EASYSense VISION 5

INTERFACES & DATALOGGERS 8

WHICH DATALOGGER 9

EASYSense SOFTWARE 10

EASYSense TEACHING MATERIALS 12

PHYSICS 14

Dynamics System 16
How To 18
Curriculum Books 19
Excellent Additions 20

CHEMISTRY PAGE 22

How To 24
Curriculum Books 25
Spectrometer 26

BIOLOGY PAGE 28

How To 30
Curriculum Books 31

SENSORS PAGE 32

NEW PRODUCTS

DATA LOGGERS

- **EasySense Vision** PAGE 5
- **EasySense 1 Link** PAGE 8

SMART Q SENSORS

- **Accelerometer** PAGE 34
- **RF Electrosmog** PAGE 44
- **Stethoscope** PAGE 46
- **Count Tachometer** PAGE 48

SENSOR ACCESSORIES

- **Gas Pressure Accessory Kit** PAGE 38
- **Anemometer** PAGE 48
- **Rain Gauge** PAGE 48

SCIENTIFIC SENSORS

- **IR thermometer** PAGE 21
- **Energy Meters** PAGE 21
- **USB Microscope** PAGE 21
- **Spectrometer** PAGE 26



The service we offer...

Assistance & Demonstrations

Are you looking:

- for a Data logging system?
- to expand the use of existing equipment?
- for new and exciting lesson plans?
- to match the equipment to your teaching syllabus

As the major supplier of Data logging systems in the UK, we understand that every school is different, and after listening to your requirements we will make recommendations appropriate to your needs.

As part of our commitment to the UK School market, we have a dedicated, specialist team that can visit your school to:

- Demonstrate the equipment
- Give all of your department 'hands on' time
- Answer questions
- Offer advice and suggestions

Call us on 01525 373666 to book an appointment.

Training & Support

We offer training to every customer who needs it. This is not simply at the time of purchase; we understand that schools sometimes need 'refresher' courses. Call on us whenever you need updating.

If you need support, call or e-mail us – we are always here to help and its completely FREE for the lifetime of the product!

We endeavour to answer all calls immediately, and reply to e-mails on the same working day.

In addition we have a comprehensive web site. *It contains:*

- Free downloads of every manual, for every Data Harvest product.
- Free software updates
- Free worksheets
- Newsletters (including special offers)
- Hints & tips (FAQ's)
- Exam Syllabus matches
- A lively forum where you can ask questions and engage with other teachers

Commitment & Experience

Data Harvest Group designs, manufactures, markets and supports all of its products here in the UK. We are over 26 years old, (formed by teachers) and we work exclusively in the Education sector.

Our commitment is unparalleled and our experience legendary. If you need good advice, call us, we promise you won't regret it!

Engage, Empower and Enhance...



Introducing EASYSense VISION

The Complete Measuring System

A new approach to science teaching

As a data logger, EasySense VISION has accepted no compromises. VISION is a fully functional high speed 4 channel logger which offers all the features you have come to expect from the combination of a Data Harvest logger and the award winning EasySense software, but in one simple self contained package. No need for workspaces cluttered with computers, no need to be reliant on networks.

- Fast switch on, no waiting for the network
- Direct connection to a projector
- Over 400+ experimental setups built-in
- Fast recording
- Long term remote datalogging
- Compatible with 50+ SmartQ sensors
- Graph any combination of 4 SmartQ sensors
- High resolution touch sensitive screen



“Quick, effective, space saving, self contained”

Order No. **2020**

COLLECT • SHOW • EXPLORE • LEARN • ACHIEVE

VISION completely replaces the standard PC & Logger or Interface combination - a huge cost saving! (it can still be used as both a remote data logger and with a PC when required).

EASYSense VISION

EasySense VISION is at the heart of the school laboratory. As a self contained system incorporating a high resolution full colour touch screen, it can capture, display and allow analysis of data without a computer.

Additionally, connect EasySense VISION directly to a projector or monitor to enable whole class investigations.

With its fast switch on, there is no waiting for the PC to boot-up or to log into the network. Fast, Efficient, Simple and productive use of the limited time available.

- 4 SmartQ Sensor inputs compatible with all SmartQ sensors
- 2 SmartQ Digital inputs used as A & B for Time /Velocity & Acceleration experiments
- Fast datalogging for Physics (Up to 50,000 samples per second)
- Long term remote datalogging (Up to 14 days logging on a single battery charge)
- Battery life : A full 'classroom day' (User replaceable Lith-ION)
- USB Client : Mouse, Keyboard, Memory Stick, Printers etc.
- USB Host : Link it to a PC and use the software running on a PC
- VGA Connection : Connect to a Projector or Monitor for whole class activities
- High resolution screen full colour, fast response to stylus or finger
- EasySense software looks and behaves the same as the PC version

Optional Accessories



1 Low Cost USB Mini Mouse

Order Code: 2031

With a retractable cable for easy storage.

2 Low Cost USB Wireless Mini Mouse

Order Code: 2032

3 Mini USB Keyboard

Order Code: 2030

An alternative to the on-screen touch keyboard.

4 USB Pen Drive (Memory Stick)

Order Code: 2033

Offers students a quick and low cost method of taking their experiment results to a PC, either in school or at home.

5 4 Port USB Hub (Powered)

Order Code: 2034

Allows the connection of multiple USB devices simultaneously (Keyboard, Mouse, Pen Drive etc.)

6 Carry Case

Order Code: 2035

Neoprene case, simple and robust design.



VISION Standalone

Record, Save, Display, Analyse and more all from VISION (without a PC!)

VISION is a full datalogger, offering all the features you would expect from a logger in the multi award winning EasySense range: general purpose classroom data logging, fast logging for Physics, long term recording for Biology & Environmental experiments and of course fully compatible with the SmartQ Sensor range.

VISION offers many new and exciting features including a full colour high resolution LCD touch screen. The graphing and analysis tools, normally only found on the PC are now built-in. VISION can even print out the graph*
VISION is truly a stand-alone data logger and analysis tool.

VISION has a large user memory for storing data files. Captured data can be transferred to a PC either by direct USB connection, or via a Pen Drive (Flash memory stick).

Tip. At the end of a lesson students can save their data to a pen drive and transfer it back to a school PC or take it home to analyse and write reports on their own PC.

**VISION is compatible with a wide range of HP printers (PCL).*



VISION With a PC

Connect VISION to a PC, and you can:

- Use VISION as an interface and control it from the PC. Great for whole class demonstrations
- Data captured on VISION can be transferred to the PC and opened directly into PC EasySense software
- Workroom setup files can be transferred to and from VISION
- Use Windows Explorer to manage VISION's storage area
 - Delete, Copy, Rename etc

VISION to PC connection is simple and straight forward:

1. Connect VISION to the PC using the supplied USB cable
2. VISION will appear as a removable storage device on the PC (No special drivers required)
3. Use Windows Explorer to drag and drop files between your PC and VISION



VISION With a projector

Simply plug VISION into a Projector (or monitor) and it automatically switches from the built-in LCD to the connected display.

This is a huge asset in a classroom setting, required whenever you need to:

- Present a teacher led demonstration to a class of students
- Introduce an experiment to the class
- Share captured data from one group with the whole class
- Provide training on how to use VISION



VISION With a Printer

Connect VISION to a suitable HP (PCL) printer to print the experiment Graph or Data Table directly.
- No PC required!

At the heart of any data capture system is either an Interface or a Data Logger.

Interfaces FOR REAL TIME RECORDING



**EASYSense
1 LINK**
Order No. 5530

**EASYSense
3 LINK**
Order No. 5540

EasySense 3 Link and EasySense 1 Link offers a convenient option for students to directly connect up to 3 sensors to a computer.

- Recording rates are selectable from a very fast 50,000 samples a second to duration of 30 days
- No batteries are needed as the interfaces and sensors are powered from the USB port
- Both Interfaces are supplied with the award winning EasySense software
- 1 Link is an exceptionally low cost interface and is ideal for those applications that require only one sensor

Dataloggers FOR REMOTE AND REAL TIME RECORDING



EASYSense Q5+ is a remote data logger with 5 popular sensors built-in, providing an attractive alternative to suit particular curriculum requirements.

EASYSense Q5+
Order No. 5025

Includes the following built-in sensors:
Temperature, Sound, Light, Pressure, Humidity
plus 2 plug-in sensors.

EASYSense Q5+ with Bluetooth
Order No. 5026

As above, but with additional Bluetooth capability.



**EASYSense
VISION**
Order No. 2002
See pages 5 to 7

Money saving bundles with 1 link



**EasySense 1 Link
+ pH**
Order No. 5531



**EasySense 1 Link
+ Motion**
Order No. 5532



**EasySense 1 Link
+ Temperature**
Order No. 5533



**EasySense 1 Link
+ Colorimeter**
Order No. 5534



**EasySense 1 Link
+ ECG**
Order No. 5535



**EasySense 1 Link
+ Sound**
Order No. 5536



**EasySense 1 Link
+ Multi Range Light**
Order No. 5537

Which Data Logger?

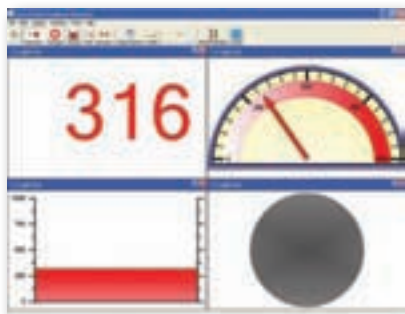
Data Harvest has a range of data capture devices to meet all requirements.



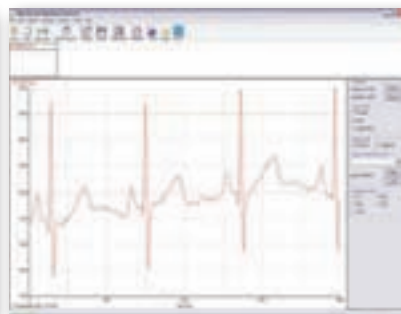
	VISION	1 LINK	3 LINK	EASYSENSE Q5+	QT TIMER
Number of SmartQ sensor Inputs	4	1	3	5 built-in 2 plug-in	2 digital
Remote Battery Life	Up to 14 days	X	X	At least 42 days	At least 42 days
Standalone Logging	✓	X	X	✓	✓
Resolution	12 bit	12 bit	12 bit	10 bit	4µs digital
Fastest Logging Speed (per channel)	≤50,000 samples per second (50kHz)	≤50,000 samples per second (50kHz)	≤50,000 samples per second (50kHz)	≤1,000 samples per second (1kHz)	X
Data Sets Stored	Limited only by memory	X	X	8	up to 254
VGA Projector Output	✓	X	X	X	X
Screen	Graphical	X	X	4 line 20 character	4 line 20 character
Dimensions (mm)	160x115x53	80x30x25	117x70x30	138x80x35	138x80x35

EASYSense Software

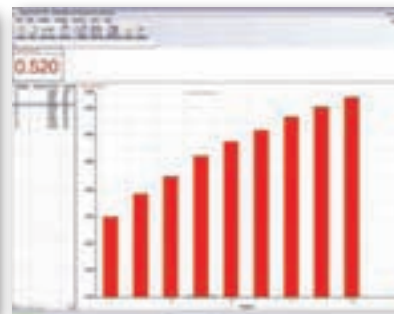
The simplicity you need with the features you desire!



Meters



Graph



Timing

Over 400 experimental setups included to ensure your practical experiment is successful.



Home Screen



Data capture could not be made any easier than with the award winning EasySense software, the foundation of our data logging system. One click gives you access to all the various data capture options.



Features Include:

- **Graph options**
 - Tiled - up to 4 graphs
 - Line
 - Bar
 - Table
 - Overlay
 - Tare
- **Analysis tools**
 - Area under the curve
 - Gradient
 - Values
 - Interval
 - Best Fit
 - Mathematical functions
 - Pre & Post logging function
- **Timing options**
 - Time
 - Velocity
 - Acceleration
 - Momentum
 - Kinetic energy
- **Oscilloscope Mode**
- Cut and Paste
- Print
- Save
- Auto scale
- Set sensor axis limits
- Selection Wizard
- Use Selection
- Pre-Trigger (25%, 50%, 75%, 100%)
- Smooth
- Continuous Logging
- Label and title graphs
- Zoom
- Predict
- 400+ setups built-in
- Export to Excel

The graphing options that teachers like!

Analysis

Within the Analysis menu there are many popular options, including, Values, Interval, Difference, Area, Gradient and Statistics (mean, max/min and standard deviation).

Tools

A wide range of options can be applied to the data. The Post and Pre log functions offer an exciting way of manipulating the data, e.g. use Voltage and Current sensors with a pre-log function to generate the resistance and/or power as a new data channel.

Overlay

Click the overlay button, to keep the current data set and add a new one to it. Very important when making multiple experimental runs so that comparisons can be made.

Meters

Table of Values

Annotation

Students can add comments and descriptions to highlight points of interest on the graph.

Values from cursor position

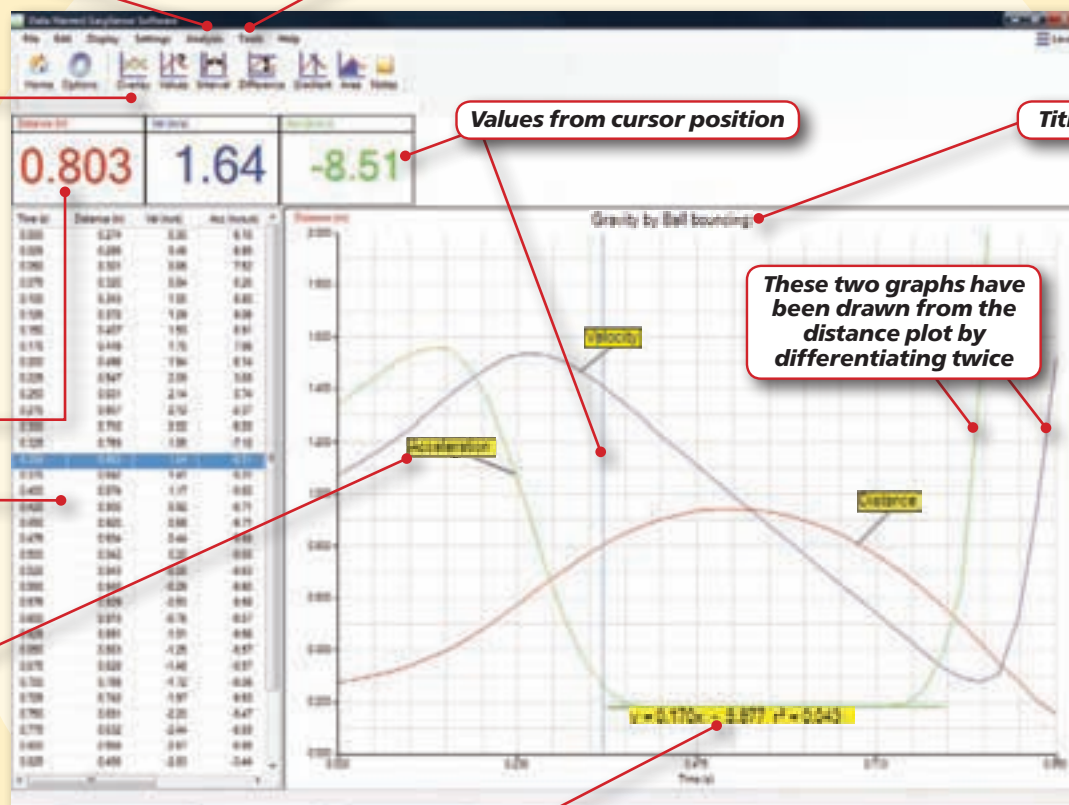
Title

These two graphs have been drawn from the distance plot by differentiating twice

Line of best fit

The line can be calculated automatically or the learner can manually plot a line of best fit using their own judgement.

This experiment is detailed in the 'How To' feature on page 18.



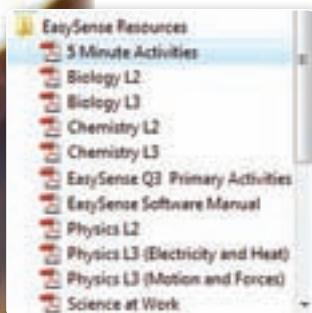
The data illustrates the determination of 'g' derived from a bouncing ball

EasySense Teaching Materials

10 folders featuring over 400 fully supported data logging activities.



EasySense software includes setup files that match all of the Teaching materials listed here and more!



A setup file pre-sets the EasySense software to suit the experiment. This greatly simplifies data collection.

Included with the Teaching materials is a CD-ROM that holds all of the Teacher's notes and Student worksheets as pdf (Acrobat) files.

For ages 11-14

- **Biology L2** Order No. 3521
- **Chemistry L2** Order No. 3523
- **Physics L2** Order No. 3525

For ages 14-18

- **Biology L3** Order No. 3522
- **Chemistry L3** Order No. 3524
- **Physics L3** Order No. 3529
Electricity and Heat
- **Physics L3** Order No. 3528
Motion and Forces
- **Physics L3** Order No. 3530
Light, Sound & Pressure

For ages 11-18

- **Science at Work**
Order No. 3520
- **Sport Science**
Order No. 3532



Which Examination syllabus are you using?

Click on the link on our website to the GCSE Charts that match the EasySense worksheets and download the chart that matches your chosen exam board specifications.

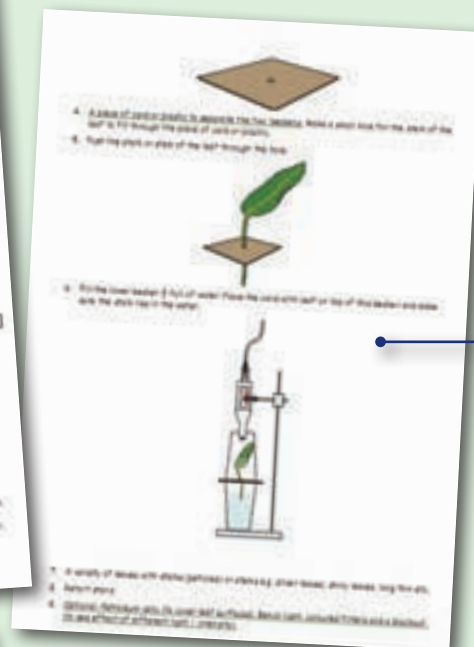
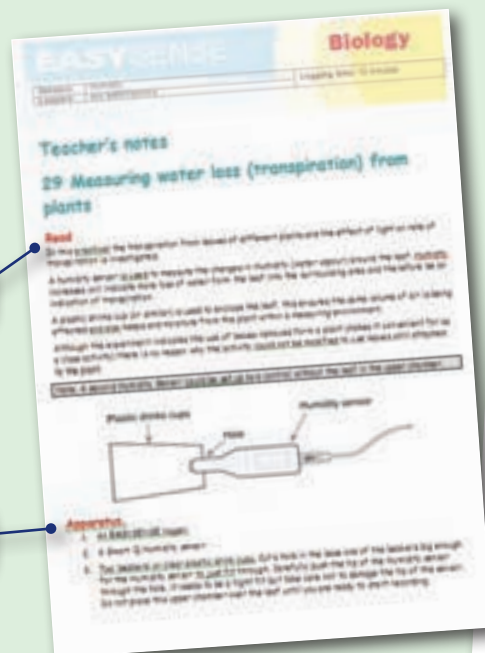
EasySense Teaching Materials, written by teachers for teachers

Experiment description

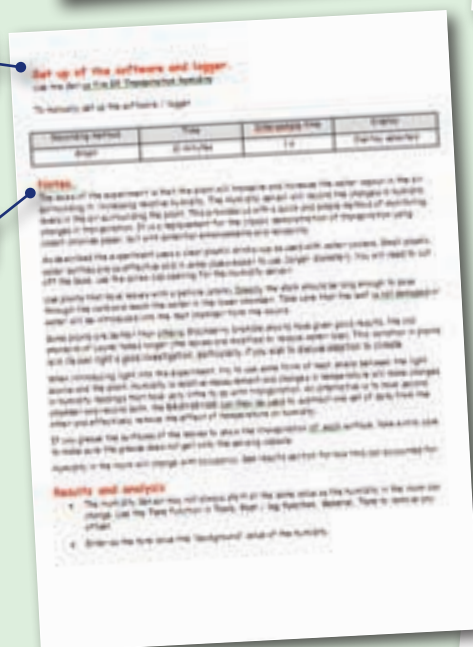
Equipment used

Set capture method

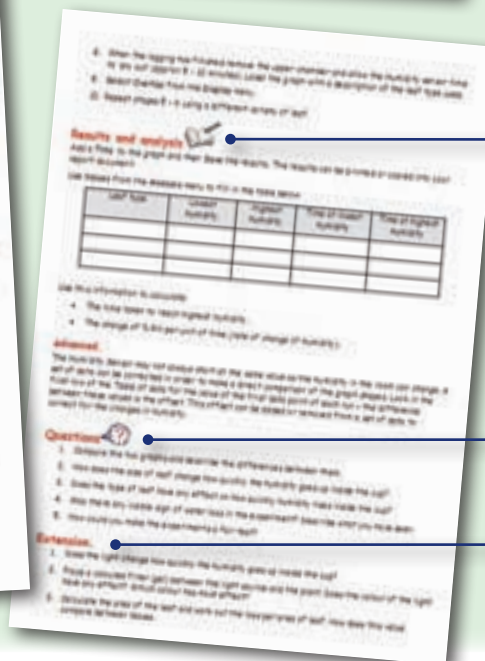
Hints and help



How to set up and run the experiment



Record the results



Test knowledge

Do more!

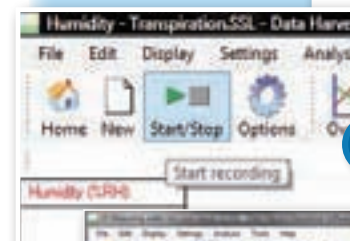
4 Steps to success...



Select the setup for your experiment



Set up the experiment with the correct sensors



**Click on Start
to collect data**



Graph of results

Engaging with Physics

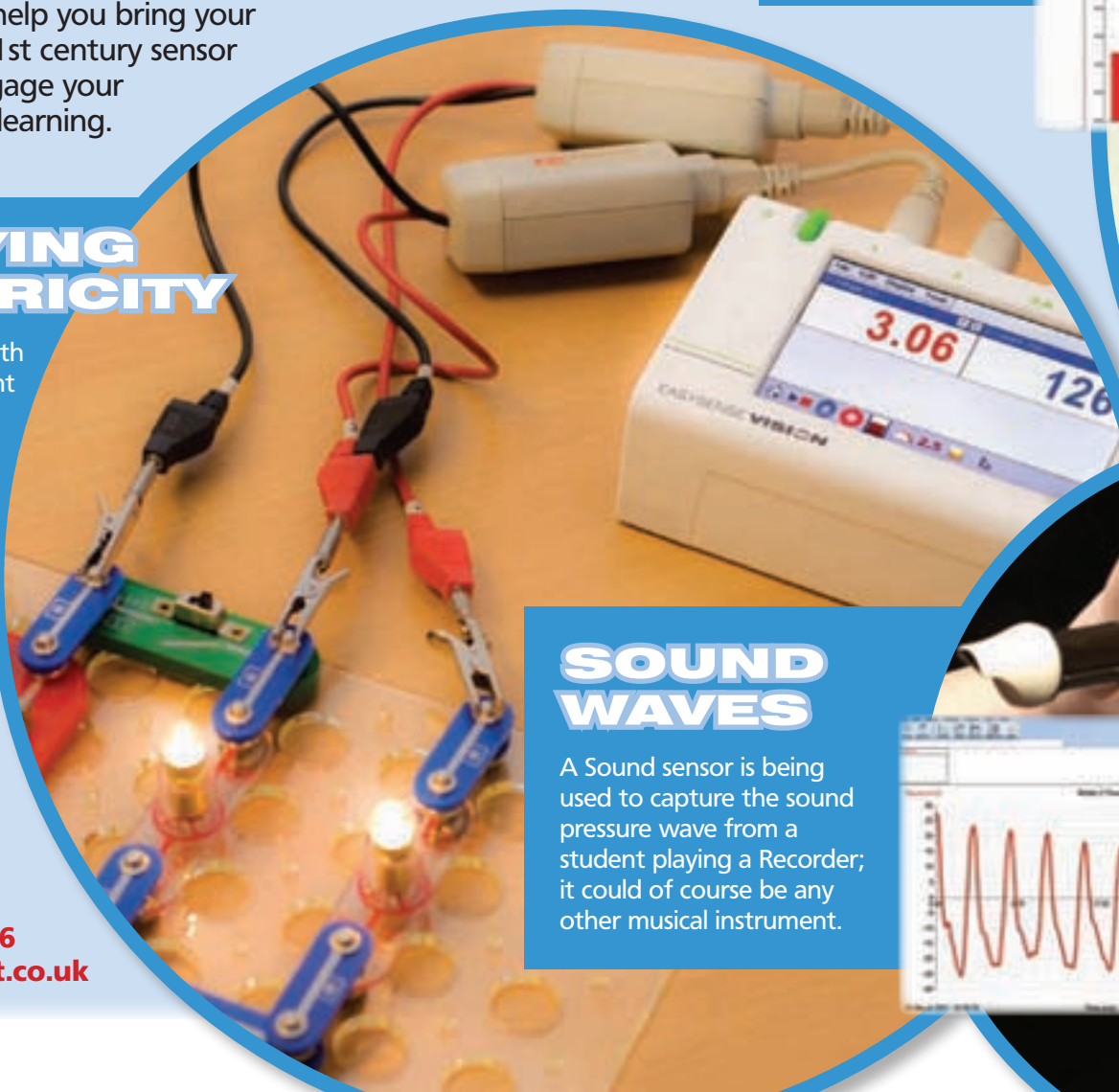
Many physics experiments occur very quickly, often in milli-seconds or even micro-seconds. Using the fast capture features within Data Harvest loggers, experiments are accurate, reliable and repeatable.

Using a datalogger really does make the invisible visible.

We offer a large range of sensors and curriculum support notes to help you bring your class to life with 21st century sensor technology to engage your students in active learning.

STUDYING ELECTRICITY

EasySense VISION with a Voltage and Current sensor attached being used to investigate the behaviour of electricity in a parallel circuit.

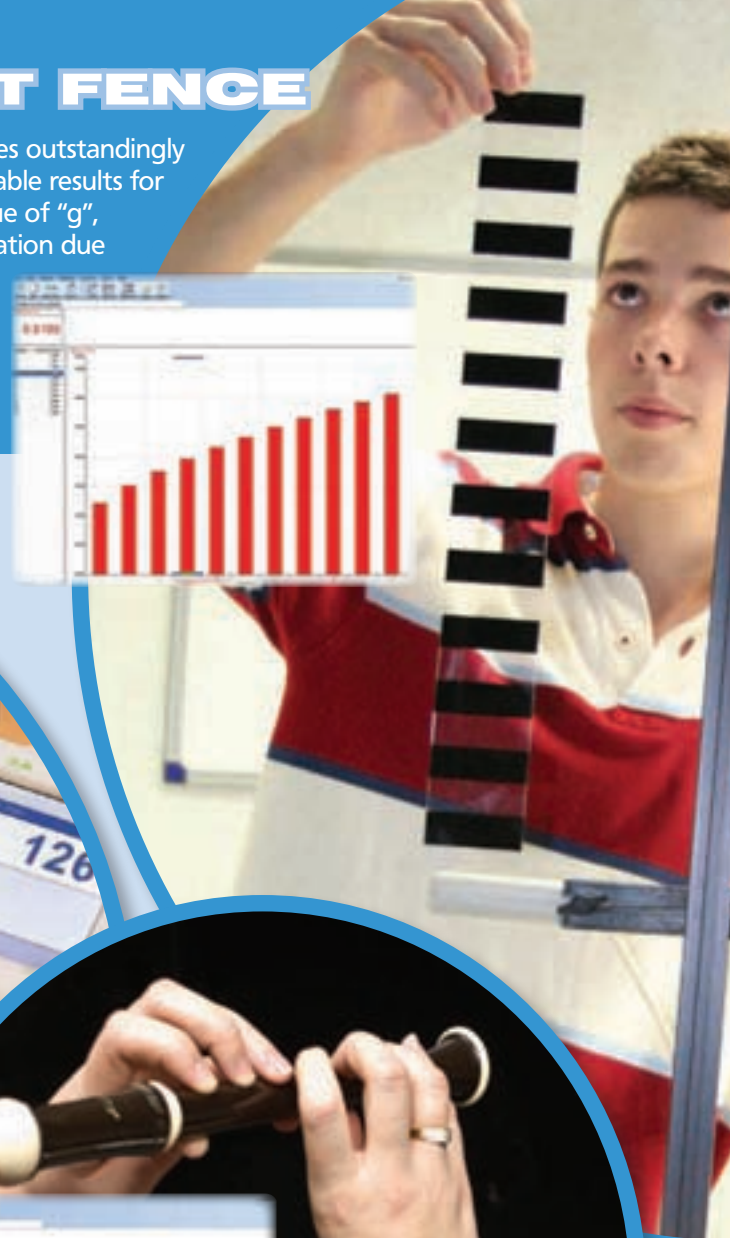


Sales: 01525 373666
www.data-harvest.co.uk

PICKET FENCE

The Picket Fence gives outstandingly accurate and repeatable results for determining the value of "g", the universal acceleration due to gravity.

The Picket Fence is just one item in the Interrupt card set see page 41



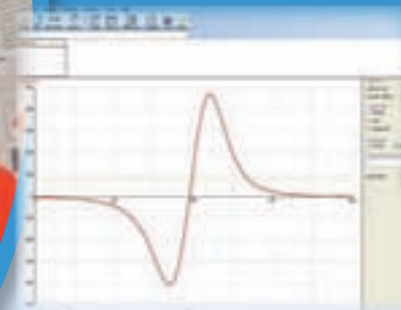
SOUND WAVES

A Sound sensor is being used to capture the sound pressure wave from a student playing a Recorder; it could of course be any other musical instrument.

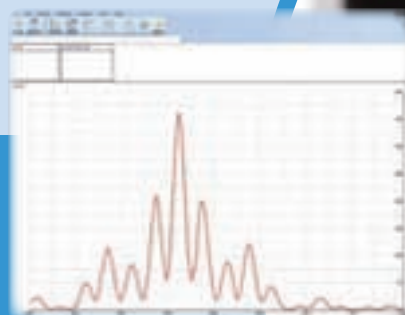


INDUCED emf

The induced emf being captured as a magnet is being dropped through a coil.



Young's slit experiments being investigated with SmarQ Laser, Light and Rotary Motion sensor on the Dynamics System.



YOUNG'S SLIT

Dynamics System

Ideal for all Physics Departments where precision and superb value for money will be appreciated.

Very few investments made in the physics lab will provide more learning opportunities than the Data Harvest Dynamics System.

- **Robust anodised aluminium construction**
- **1.2m long Incline Track**
- **SmartQ sensors fit easily and are aligned for reliable measurements**
- **Accurate and repeatable results**
- **Saves valuable lesson time**
- **The Dynamics System is so versatile it could be called a Physics Work Station**

Experiments include:

- **Motion • Time • Velocity • Acceleration**
- **Friction • Newton's 2nd Law • Free fall**
- **Atwood's Machine • Pendulum • Forces**
- **Impulse • Young's Slit (single and double)**
- **Collisions (elastic and inelastic)**



Order No. 3800



Dynamics Cart with various optional attachments



*Very low friction
Nominally 330grms*



*Masses attached for
Newton's 2nd Law*



*Rubber and solid
bumpers*



*Spring attached for
Elastic collisions*



*Single and double
interrupt card*



Reflector for Motion Sensor



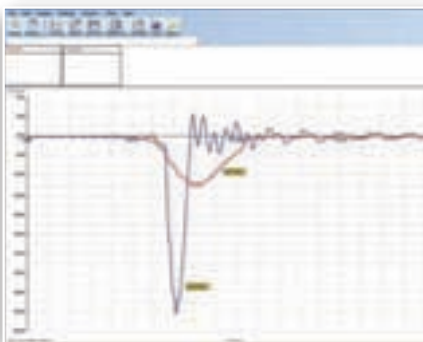
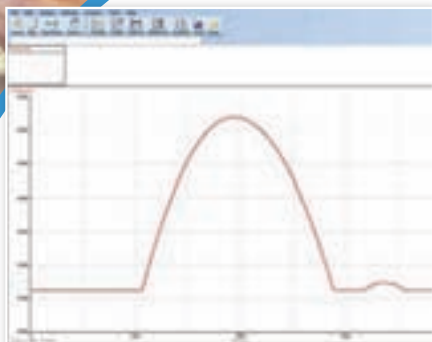
*Magnets for both elastic
and inelastic collisions*

Dynamics System

Order No. 3800

This self-assembled, smart black anodised aluminium track and support pillar comes with a low friction red cart, spoked pulley and various brackets to form a high quality, modular dynamics track.

Motion sensor plotting the distance-time relationships of a cart.



A cart crashing into the Force sensor to study impulse.

Optional Extension Pack

Order No. 3801

Extends the Dynamics System's range of investigations into the following:

- *Motion*: Using the spring to roll a cart up a slope
- *Pendulum*: Using a Light Gate and simple pendulum
- *Collisions*: Elastic and inelastic
- *Collisions*: Using Motion sensors, Force sensors and a Light Gate
- *Collisions*: Using a Force Sensor and a Light Gate to investigate crumple zones
- *Simple Harmonic Motion*: using 2 Force and a Motion sensor with a cart oscillating horizontally

Contains: an extra cart, magnets and holders, springs, an end reflector card, pendulum bob, slotted mass set, mass retainers, sensor clip, plus an interrupt card set [1 x single, 1 x double and 1 x multi-segmented (picket fence)].



EASYSense Qt

Order No. 4010

An ideal companion for the Dynamics System is the EasySense Qt, a low cost standalone instrument for measuring time, velocity, acceleration and period from one or two inputs.

Sales: 01525 373666 • www.data-harvest.co.uk



Sensors used: Motion

- Recording times
- 20 ms intersample time
- 10 seconds of recording
- Trigger to record when ball is 30 cm from sensor



How To... Study free fall, acceleration due to gravity and energy changes in a falling ball.

A modern interpretation of Galileo's classic experiment. No need to visit the leaning tower of Pisa. All you need is a ball, a retort stand, Motion sensor and a small area of lab space.

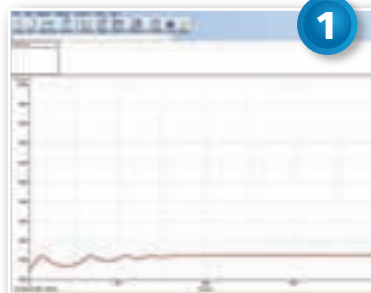
For students showing the relationship between velocity, acceleration and energy changes as the ball falls is a revelation. So much more use than an abstract description.

You will need to use a trigger to make logging commence as the ball is dropped and the advanced calculation functions built into the EasySense software.

What you need.

- A large bouncy ball of reasonable weight
- 1 Motion sensor
- A retort stand, boss and clamp
- A set of scales to weigh the ball

Details of the experiment can be found in Physics L3 (Motion and Forces) - experiment 24 Acceleration due to gravity - by free fall and experiment 37 Conservation of energy - bouncing ball. A free download is available from our website.



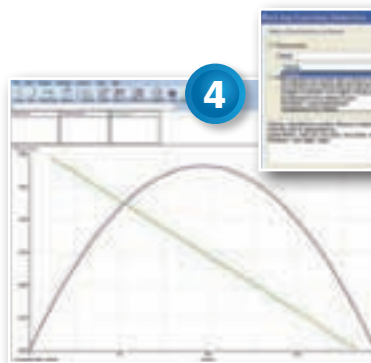
Data as collected. The ball was released from under the Motion sensor. A trigger started data collection and several bounces of the ball were recorded (the ball needs to bounce on a hard surface).



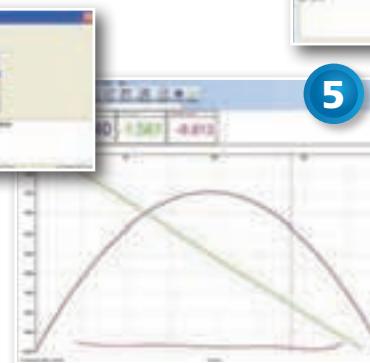
Select the first clean bounce recorded, then Use Selection (Edit menu).



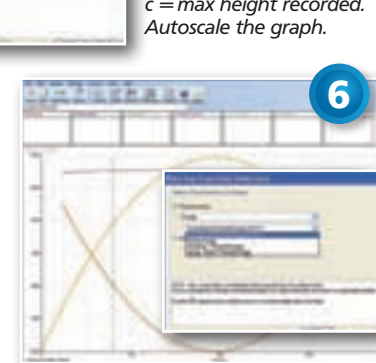
Correct the distance values to read from the floor not the sensor using the Post-log Formula function ax^2+bx+c . Make $a=0$, $b=-1$, $c = \text{max height recorded}$. Autoscale the graph.



Hide the uncorrected data (Show or Hide Channels). Use the Post-log Preset function, Motion, Velocity to calculate the velocity of the falling ball.



Use the Post-log Preset function, Motion, Acceleration (from velocity data) to calculate the acceleration of the falling ball. Axis limits adjusted using Sensor Settings.



Use the Post-log Preset function, Energy to calculate the GPE and KE of the falling ball. Add the GPE and KE data together to show energy is conserved.

Physics Curriculum Books

167 fully detailed experiments showing in detail teacher and student materials.

There are just two many experiments to possibly list them all here, full details can be found on our web site.



Order No. 3525
Physics L2
(for ages 11-14)



Order No. 3528
Physics L3
Motion and Forces
(for ages 14-18)



Order No. 3529
Physics L3
Electricity and Heat
(for ages 14-18)



Order No. 3530
Physics L3
Light, Sound and Pressure
(for ages 14-18)



PHYSICS L2

- 01 Comparing fuels
- 04 Making electricity from sunlight
- 05 How hot does the water get from the sun?
- 06 What changes current in a circuit?
- 07 Can you use bulb brightness to measure current?
- 08 Electric current in circuits
- 11 Fuses - Do fuses blow at their rated current?
- 12 What decides if something floats or sinks
- 13 How does upthrust change as an object sinks further into a liquid?
- 14 Upthrust and floating
- 15 How do different materials stretch?
- 17 Investigating friction
- 19 How does the strength of an electromagnet vary?
- 20 How does coiling a wire affect the strength of the electromagnet?
- 21 What happens to an alternating current used in electromagnets?
- 22 Reflections
- 23 How does the intensity of light change with distance?
- 24 What happens to the brightness of a bulb as voltage is changed?
- 25 What happens to the brightness of bulb as voltage is changed
- 26 Long wires, less power?
- 27 Speed of sound
- 29 Measuring speeds on a runway
- 32 Acceleration
- 33 Streamlining
- 34 Energy and heat
- 35 Induction in a coil
- 36 Forces in Levers - How do levers balance? Principle of moments
- 37 Pulleys

PHYSICS L3 - Motion and Forces

- 01 Introducing the Motion sensor
- 03 Measuring speeds on a track
- 07 Acceleration (calculated by students)
- 12 Motion down an inclined plane using a Light gate and spoked pulley
- 13 Motion up and down an inclined plane
- 14 Simple harmonic motion
- 18 Relationship between period and the length of the pendulum
- 19 The relationship between a pendulum period and its' amplitude
- 23 Acceleration due to gravity using a picket fence and Light Gate
- 26 Newton's second law
- 28 Conservation of linear momentum
- 29 Explosions and recoil
- 31 The bungee jump - resultant forces
- 34 Centripetal force in a pendulum
- 35 Conservation of angular momentum (1)
- 38 Investigating the work energy law $W = dEk$
- 39 Forces acting on a floating object
- 40 How does upthrust change as an object sinks into a liquid?
- 44 Force extension characteristic for a spring/elastic material

PHYSICS L3 - Electricity and Heat

- T01 The coffee problem, "Must phone off, the coffee is getting cold"
- 02 Cooling by evaporation
- 03 How does sweating keep you cool?
- 04 Cooling substances
- 05 Heat transfer
- 06 Radiate energy (Leslie's cube)
- 07 Relationship between temperature and radiated energy
- 08 What type of surface absorbs radiant energy?
- 09 Why insulate houses? A hotter house for less greenhouse gas

- 11 Conduction and convection
- 13 Which is the best conductor of heat?
- 14 Which material is the best absorber of heat?
- 15 Residual heat
- 18 Equivalence of heat energy liberated to electrical energy dissipated
- 19 Stefan - Boltzmann law using a tungsten filament lamp
- 20 Calibration of a thermometer
- 21 Specific heat capacity
- 23 Using U values, how heat is lost
- 24a/b Angle of the sun and collected energy
- 24b Angle of the sun and collected energy - using an artificial sun
- 25 What changes the current in a circuit
- 26 Good and bad connectors
- 31 Electric current in circuits
- 34 Ohm's Law
- 35 Electrical characteristics resistor, lamp diode and LED
- 36 Time constant for a capacitor
- 38 Energy stored in a capacitor
- 39 Startup current of a light bulb
- 41 Induction of a current in a conductor
- 42 Induction of a voltage in a coil
- 43 What happens when a magnet spins in a coil?
- 44 Efficiency of an electric motor/generator
- 45 Electricity from water power
- 47 Measuring the strength of an electromagnet
- 49 Alternating current is used to make an electromagnet
- 50 How does the magnetic field in a coil vary as the current varies
- 51 The force acting on a current carrying conductor in a magnetic field
- 53 Mapping the magnetic field of a bar magnet
- 54 Efficiency of a transformer
- 55 The d.c. characteristics of a diode
- 57 The input characteristic of a transistor
- 59 Reactance and phase in a capacitor
- 62 Resonance in a series LCR circuit

PHYSICS L3 - Light, Sound and Pressure

- 01 Reflectivity
- 02 How does the intensity of light change with the distance from the light?
- 03 Polarised sunglasses
- 04 Investigating interference
- 06 Infra red in the spectrum
- 07 An experimental estimation of Planck's constant
- 08 Fast light
- T09 The Big squeeze
- 10 How does pressure change with height?
- 11a, b, c How does pressure change with depth and density
- 12 Pressure and heat
- 13 What happens to the temperature of a gas if the pressure is changed?
- 14 Boyle's law ($P+V$)
- 15 Temperature volume relationship in a gas
- 16 Pressure temperature relationship of a gas - estimating absolute zero
- 17 Dalton's law of partial pressures
- 18 Determination of R, the gas constant
- 20 Investigating waves and sounds
- 20a Investigating sounds: the effect of musical instruments
- 21 Interference in sound waves
- 22 Investigating resonance in pipe
- 23 Investigating resonance in pipe
- 24 Voice recognition

Physics Excellent Additions

Amusement Park Experience

2264 Pieces • For 6 to 8 children

Order No: KX78890

This large set supports 6 – 8 learners working in groups, and explores mechanisms, scientific concepts and mathematics in Fairground rides.

- Builds 13 models. Build the roller coaster and a ride model; or 2 of most ride models simultaneously
- Building instructions included, some on CD
- Teacher's Guide included with full background information
- 2 Battery motors included
- Packed in 3 strong, stackable storage trays with dividers and lids



Forces, Energy and Motion

442 Pieces • For 4 to 8 students

Order No: KX78790

With various motors and different sizes and styles of wheels and tyres, this set supports practical investigations into potential and kinetic energy, force, speed/velocity, friction and motion.

- Builds 11 models, 4 of most models simultaneously
- Includes 2 battery motors*, 2 flywheel motors and 4 spring motors (and rubber bands)
- Teacher's Guide included with 7 enquiry-based lesson plans, reproducible student worksheets, teacher's notes and challenge activities
- Packed in a strong, stackable storage tray with dividers and lid

**requires 2 AA batteries for each motor*



Roller Coaster Physics

2037 Pieces

For 6 to 8 students

Order No: KX78800

This large set includes 2 cars and a battery powered motor. Science investigations are brought to life using Roller Coaster models.

- Builds 11 models, including 2 Roller Coaster designs and ramp and loop systems.
- Builds 1 Roller Coaster and any 2 ramp/loop systems simultaneously.
- Building instructions included, some on CD
- Teacher's Guide with lesson plans, background information and teacher's notes included.
- Packed in 3 strong, stackable, storage trays with dividers and lids.



Exploring Machines

1432 Pieces

For 4 to 8 students

Order No: KX78600

The metallic colour of this set is aimed at older students. For 4 – 8 students working in pairs, investigating the use of levers, pulleys, wheels/axles, inclined planes and gears in more complex models e.g: a 2-gear transmission system, rack and pinion system, lift, crane, garage door and conveyor belt.

- Builds 30 models, 4 of each type of model simultaneously
- Teacher's Guide includes lesson plans, background information and reproducible worksheets
- Packed in a strong stackable storage tray with dividers and lid



K'NEX Education

Real Bridge Building

2282 Pieces

For 4 to 8 students

Order No: KX78680

For 4 – 8 students working in groups. This large set builds replicas of real-world bridges up to 1.8 metres long and includes instructions to build the Sydney Harbour Bridge, Forth Rail Bridge, London's Tower Bridge, San Francisco's Golden Gate Bridge and others.

- Builds 7 replica models, 2 at a time
- Models demonstrate 7 key bridge types: arch, beam, bascule, cantilever, cable-stayed, truss and suspension.
- Teacher's guide with lesson plans, background information, teacher's notes and reproducible worksheets included
- Packaged in 2 strong stackable storage trays with dividers and lids



Energy Meter

Order No: 3902

Wireless Energy Meter

Order No: 3908



Eco Eye Elite Model



Eco Eye

The eco eye energy meters will let you record the energy use of appliances. The display shows the cost (after entering the price tariff), Voltage of the supply, Current used, frequency (Hz), total energy (KWh) lowest energy and maximum energy use (KWh). The elite unit has a display that can be moved around or mounted on a wall, in addition it will also show energy use as CO2 production (Kg)

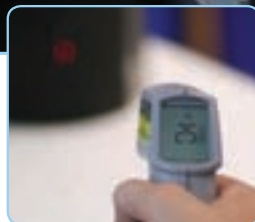
"By 2020, the Government would like all schools to be models of energy efficiency, renewable energy use and water management. They should take the lead in their communities by showcasing wind, solar and bio-fuel energy, low-energy equipment, freshwater conservation, use of rainwater and other measures"

IR Thermometer

Order No: 3906

Simply point the thermometer at an object or subject, the in built laser guides you and the surface temperature is immediately displayed.

- Temperature range: -20 to 320°C
- Powered by 9v battery
- Backlit LCD and Laser Sighting



USB Microscope

Order No: 3900

This amazing microscope, powered directly from the USB provides magnification 20 to 200 times.

A focus range of 10mm to infinity.

The included software allows screen and video capture.



Spectrometer

Order No: 3310

The Spectrometer is a low-cost, small footprint laboratory Spectrometer that's ideal as a general purpose instrument for analysing colour and wavelength.

See page 26 for details.



Hand Held Dynamo

3v Order No: 3904

6v Order No: 3905

A simple demonstration of converting mechanical energy into electrical energy.



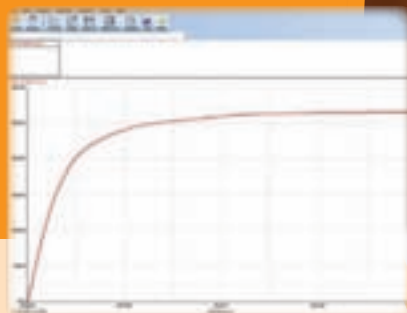
Engaging with Chemistry

Collecting data electronically offers many real advantages over pen and paper recording. The EasySense software gives the student confidence, so there are no missed data points. How many times have you and your students disagreed about the end point in titration? Use the EasySense software to calculate the first derivative to produce a clear unambiguous end point.

With every student collecting the data for the same length of time and with the same time interval between recordings, sharing results becomes simplified. Whole class discussions on the data become a natural part of the lesson. Immediate graphical presentation of the data creates rapid, effective feedback from the work in progress.

RATES OF REACTION

Rate of reaction of marble chips and acid being studied. Using a Drop Bubble counter to measure the rate of gas production.



Sales: 01525 373666
www.data-harvest.co.uk



COLORIMETRY

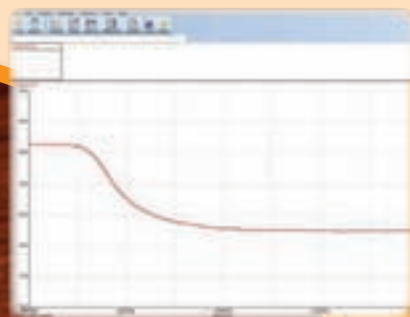


Colorimeter being used to record and plot the results of a Beer Lambert's law based investigation.

SPECTROMETRY

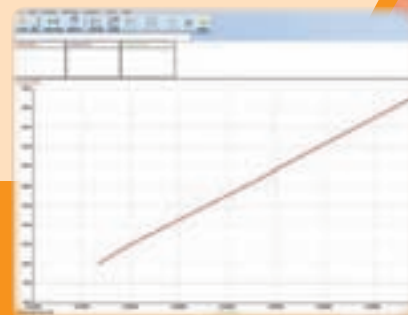
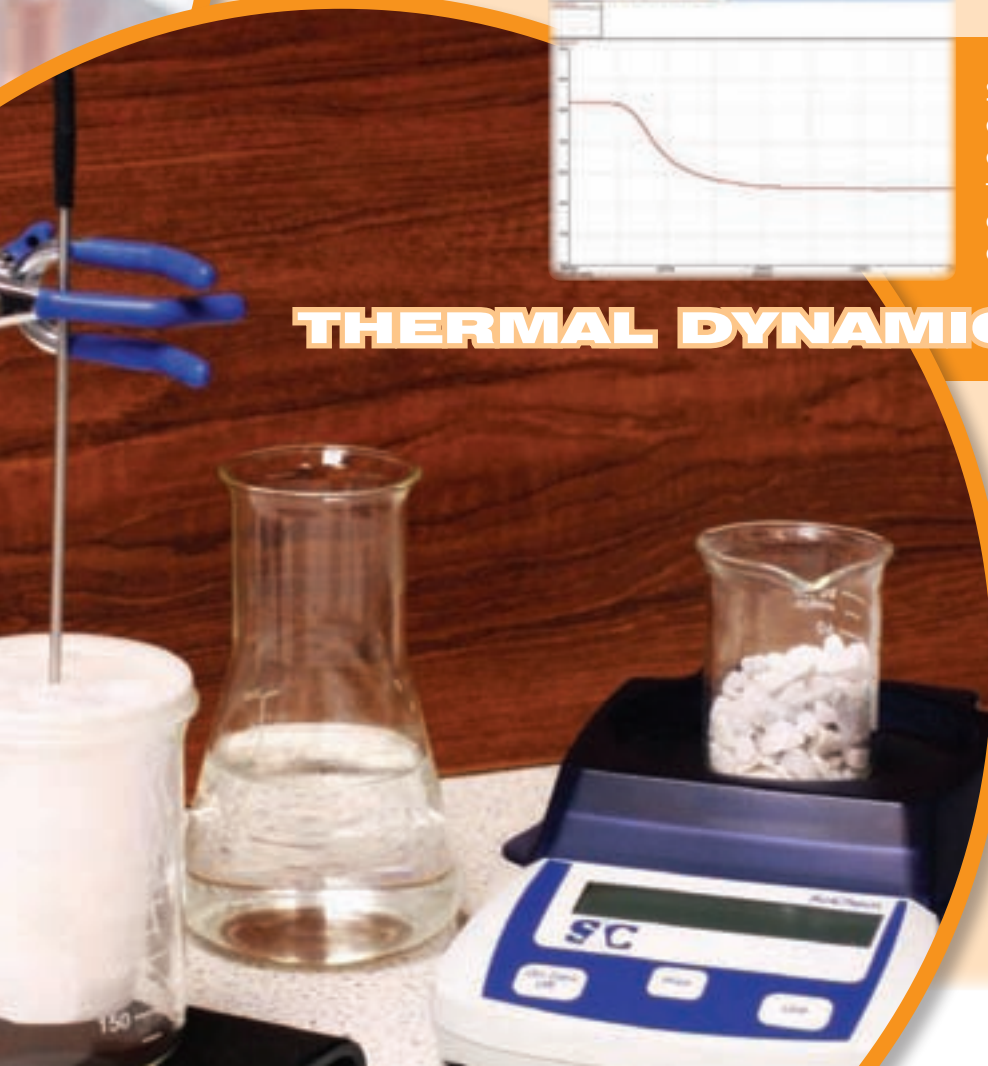
Spectrometer being to record rates of reaction by change in colour of reactants and or products.

Direct molar concentration changes are possible using the user defined scale.



Simple calorimeter experiments can be enhanced by collecting the full temperature change cycle in the experiment.

THERMAL DYNAMICS



GAS LAWS

Quick simple investigation into gas laws, studying the relationship between volume, temperature and pressure.



How To... find the end point in a Titration.

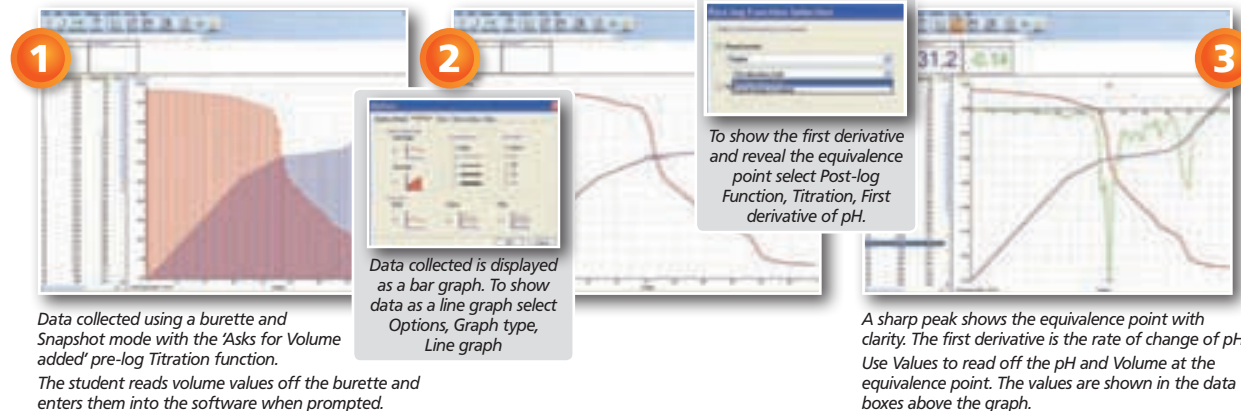
Titration is an essential skill for a chemist. It takes a lot of practical skill to do well and get repeatable results.

Using an automated titration sensor allows the data to be collected while the student is free to learn the maths that follows.

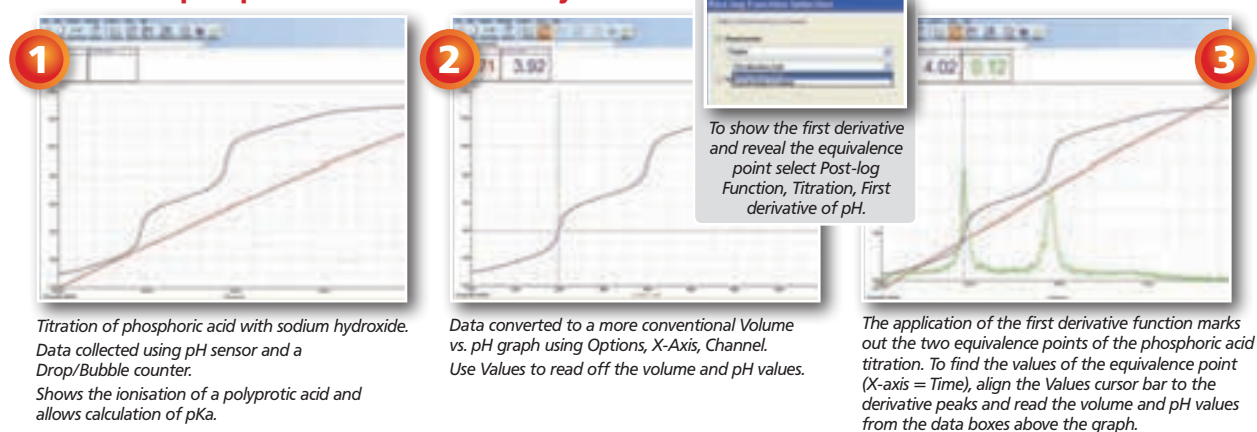
End points of titrations are difficult to determine. Even with the best indicators, experience is a valued asset, something the students do not have. The results from the titration are however critical for examination success and subject knowledge.

Why not use a mathematical tool? The first derivative will identify the end point without ambiguity to an accuracy of 0.04 of a cm^3 .

Titration of sodium hydroxide against hydrochloric acid using equal molar solutions



Titration of phosphoric acid with sodium hydroxide



What you need.

- A pH sensor
- Drop Counter with reagent reservoir or Burette
- Acid and alkali solutions
- Flasks, beakers and magnetic stirrer

The experiment is fully described in Chemistry L3 experiment 37 - Acid base titration: Polyprotic acids, titration of phosphoric acid and 34 - Acid Alkali titration using a burette.

A free download is available from our website.



pH Order No. 3125PK



Drop Counter Order No. 3266

Sensors used: pH • Drop Counter

Chemistry Curriculum Books

92 fully detailed experiments showing in detail teacher and student materials.

Set up files for every experiment is pre installed with the latest EasySense software.



Order No. 3523

Chemistry L2 (for ages 11-14)

21 useful data logging activities to support the core Chemistry curriculum for this age group. With detailed Teacher's notes.

Activities include the following topics:

- Acid/alkali
- Fuels
- Chemical reactions



Order No. 3524

Chemistry L3 (for ages 14-18)

A comprehensive collection of over 50 practical Chemistry activities specifically written to illustrate existing principles and cover exam syllabii and beyond.

The areas covered are:

- Fuels
- Displacement reactions
- Calorimetry
- Titrations
- Physical and analytical chemistry



CHEMISTRY L2

- 01 How hot can water get? 1
- 02 How hot can water get? 2
- 03 How hot can water get? 3
- 04 Measuring PH values
- 05 What is the pH value of water
- 06 Comparing the effectiveness of antacids
- 07 A chemical reaction using two chemicals found in the home
- 08 What happens when an acid is mixed with an alkali?
- 09 Acid base titration: Sodium hydroxide with hydrochloric acid
- 10 Burning a fossil fuel
- 11 Hot and cold reactions
- 12 Does mass change in a chemical reaction
- 13 Using mass loss to see how quickly a reaction takes place
- 14 Rate of reaction: Marble chips and hydrochloric acid
- 15 Evaporation
- 16 What happens when salt dissolves in water?
- 17 Heat of vapourisation of a liquid
- 18 Hydrogen bonding - evaporation
- 19 Citrus power
- 20 What happens to mass as a fuel is burnt?
- 21 Good and bad conductors

CHEMISTRY L3

- 01 Burning a fossil fuel
- 02 Comparing fuels
- 03 Good and bad conductors
- 04 Electric lemons
- 05 Reduction potentials - micro Voltaic cells
- 06 Faraday's laws of electrolysis
- 07 Potentiometric study of a mixture of halide ions
- 08 A displacement reaction
- 09 Hot and cold reactions
- 10 Measurement of enthalpy changes: calorimetry
- 11 Measurement of enthalpy changes: Endothermic reactions
- 12 Hess's law: Sodium hydroxide and hydrochloric acid
- 13 Heat of combustion: Magnesium and oxygen
- 14 Heat of solution - adding salt to water
- 15 Measuring pH values
- 16 Measuring pH values of everyday substances
- 17 What is the pH value of water?
- 18 Comparing the effectiveness of antacids
- 19 What happens when an alkali is mixed with an acid?
- 20 A chemical reaction using 2 chemicals found in the home
- 21 Buffer solutions
- 22 Change of state from solid to liquid
- 23 Change of state from liquid to gas
- 24 Heat of fusion of ice
- 25 Hydrogen bonding - evaporation
- 26 Heat of vapourisation of a liquid
- 27 Boyles law
- 28 Temperature volume relationship in a gas (Charles law, Gay-Lussacs law)
- 29 Pressure temperature relationship of a gas, absolute zero
- 30 Daltons law of partial pressures

- 31 Molar mass of a volatile liquid
- 32 Determination of R, the gas constant
- 33 Determination of n for a chemical reaction
- 34 Acid alkali titration using a burette
- 35 Acid base titrations: Sodium hydroxide against hydrochloric acid
- 36 Acid base titrations: Sodium carbonate against hydrochloric acid
- 37 Acid base titrations: polyprotic acids, titration of phosphoric acid
- 38 Acid base titrations: polyprotic acids, determination of the molar concentration of phosphoric acid in cola
- 39 Acid base titrations: Alanine with sodium hydroxide
- 40 Acid base titrations: a thermometric titration
- 41 Acid base titrations: a conductometric titration of sodium hydroxide with hydrochloric acid using a burette
- 42 Acid base titrations: sodium hydroxide with hydrochloric acid
- 43 Acid base titrations: barium hydroxide with hydrochloric acid
- 44 Rate of reaction: marble chips and hydrochloric acid
- 45 Rate of reaction: Which catalyst is best?
- 46 Rate of reaction: Light transmittance of hydrochloric acid and sodium thiosulphate
- 47 Autocatalytic oxidation of ethanedioate by manganate (VII)
- 48 Finding the concentration of a solution using Beer Lambert's law
- 49 Finding the concentration of chlorine using Beer Lambert's law
- 50 Determination of the manganese content of a paper clip
- 51 Stoichiometry of the copper - EDTA complex
- 52 Chemical equilibrium, calculating Kc
- 53 Colorimetric determination of glucose concentration
- 54 Comparing and measuring the viscosity of liquids
- 55 A demonstration of Grahams law of effusion



Introducing our amazing low-cost, high quality Spectrometer

The Data Harvest Spectrometer is a low-cost, small footprint laboratory Spectrometer that's ideal as a general purpose instrument with applications in Physics, Chemistry and Biology.

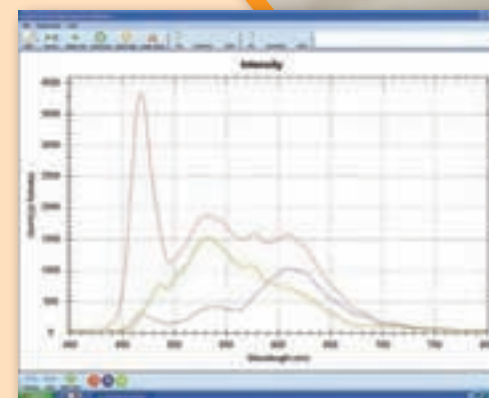
The uses of Spectrometry can be found in many walks of life from drug detection and criminal detection through to research studies.

The Data Harvest Spectrometer is cleverly designed to be both a spectrometer and spectrophotometer.

Power is derived from the USB connection, therefore no external power is required from either batteries or mains power.

- **Modular system**
- **Complete package**
- **Powered from USB**
- **1.2m fibre optic cable**
- **High intensity white LED**
- **VIS and VIR spectroscopy**

The Spectrometer is a standalone instrument that connects directly to the USB port. It is not part of the SmartQ range of sensors.



Using overlay mode to show the spectrum of different colours.

"At last a Spectrometer that schools can afford."



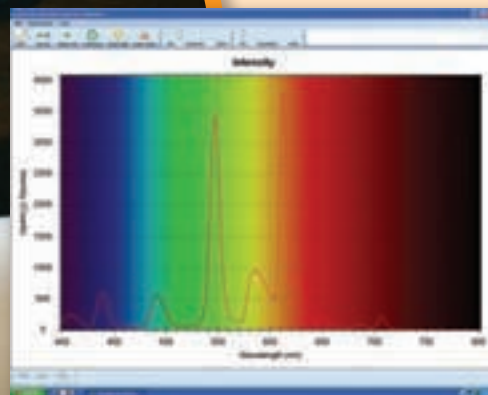
Cuvette attachment

Applications Include:

- Analysing the visual spectrum
- Beer Lambert's Law
- Plank's constant - determination of wavelength
- Absorbance spectrum of a liquid
- White light
- Forensic science
- Photosynthesis
- Colorimetry

Fibre optic attachment

Spectral response of a fluorescent lamp.

**Order No. 3310****Specifications**

The system comprises of the Spectrometer base unit, cuvette holder (with a broad spectrum solid state light source), 1.2m optical fibre accessory, USB cable, software and carry case.

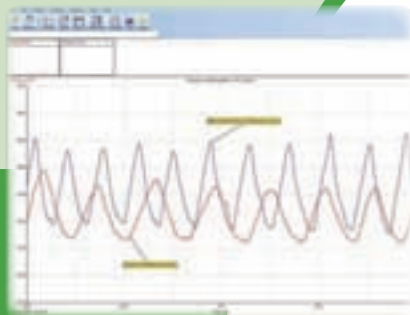
Calibrated spectrum range	400nm to 750nm
Resolution	1.5nm
Accuracy	±3nm
Integration Time	9ms to 3s (adjustable)
Dynamic Range	12bit



Engaging with Biology

Biological processes can be slow, sensors and automated data collection allow the student to be involved in setting up the experiment, defining the data collection parameters (there by gaining ownership of the data) and allows them to complete long experiments when only short time is available.

Set the work up today, start data collection, collect the graph next lesson and start discussing the meaning of the data.



HUMAN BIOLOGY

Use sensors to explore human physiology. A Breathing Belt and Pressure sensor to record breathing patterns.

Sales: 01525 373666
www.data-harvest.co.uk

TRANSPIRATION

Use a Humidity sensor to record water loss from a plant leaf over a period time. The USB microscope can show and record leaf details.





SPECTROSCOPY

Spectrometer investigating the differences in plant pigments and chlorophyll.



Close up of a leaf through the microscope.



FIELDWORK

EasySense VISION and sensors being used to collect environmental data.

DNA

A wonderful hands-on set for building DNA strands. As K'NEX components can be assembled quickly and unsnap easily, this colour-coded set is ideal for reinforcing studies into the structure and function of the molecules that make up DNA and mRNA.

Order No. KX78780



How To... Monitor transpiration of a living plant over several days.

Transpiration is normally studied by taking the leaves off a leafy stem from a plant and measuring changes of mass and water flow.

For students the removal of the plant material from its context can lead to a conflict.

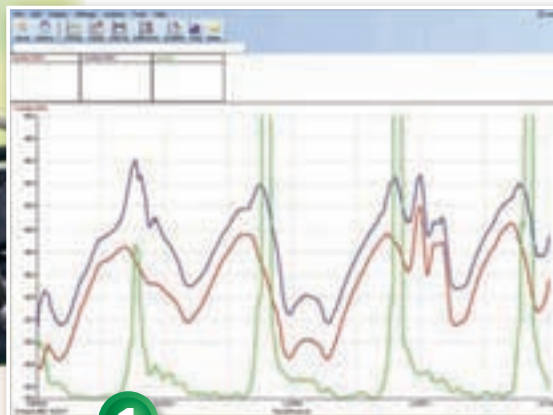
What if the students could measure transpiration over a period of time directly from a living plant? Using two Humidity sensors with small canisters makes this a simple experiment to conduct and produces excellent contextual data for analysis.

What you need.

- A plant with large leaves
- 2 Humidity sensors
- 1 Light sensor (optional)

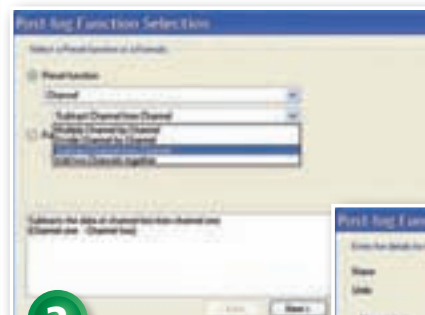
Details of the experiment can be found in Biology L3 experiment 30 Transpiration: Difference between leaf surfaces.

A free download is available from our website.



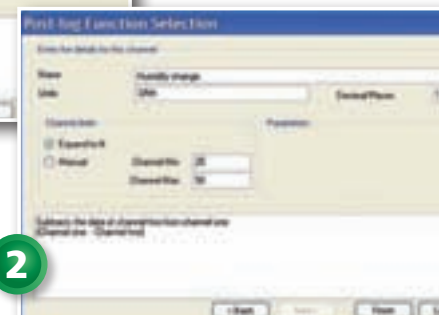
1

Data as collected. Humidity is affected by temperature. Using 2 Humidity sensors allows the humidity on each surface of the leaf to be recorded. It also allows the sensors to be used as the control for each other



2

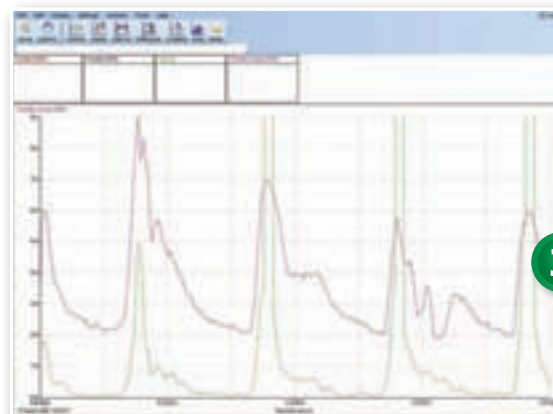
Subtraction of one humidity data set from the other will remove the effect of temperature on humidity and reveals the change in humidity of the lower surface relative to the upper leaf surface.



2

Select Post-log Function from the Tools menu and use the 'Subtract Channel from Channel' function to subtract the data of one humidity channel from the other. Use Add Text to label the graph lines.

Tip: When creating a new data channel give the data a clearly identifiable name.



3

Finally right click in the graph area and use Autoscale to maximise the data.

The relationship between light and transpiration is clearly shown.

Sensors used: Humidity • Light



Humidity Order No. 3145



Light Order No. 3124

Biology Curriculum Books

125 fully detailed experiments showing in detail teacher and student materials.

Set up files for every experiment is pre installed with the latest EasySense software.



Order No. 3521
Biology L2
(for ages 11-14)

22 practical activities for students studying the core Biology curriculum.

The activities include:

- Measuring pulse
- Breathing patterns
- Oxygen consumption
- Food as fuels
- Respiration
- Photosynthesis
- Transpiration and Plant growth
- Reaction times
- Body heat



Order No. 3522
Biology L3
(for ages 14-18)

This 400 page book contains a comprehensive collection of over 70 practical Biology activities, supported by detailed Teacher's Notes.

Areas covered include:

- Human Physiology
- Plant Biology
- Biochemistry
- Applied Biology
- Food Science and the Environment



BIOLOGY L2

- 01T Pulse
- 02T Armchair gymnastics
- 03 Not only exercise excites the heart
- 04 Food as fuel
- 05 Breathing patterns
- 06 Rate of consumption of O₂ to measure of respiratory activity
- 07 Rate of production of CO₂ to measure of respiratory activity
- 08 Temperature changes as a measure of respiratory activity
- 09 How does photosynthetic activity vary with light intensity?
- 10 Measuring water loss (transpiration) from plants
- 11 Growth in a plant, as a measure of photosynthetic activity
- 12 Regulation of body heat
- 13 Hot stuff!?
- 14 How does sweating keep you cool?
- 15 Should I use deodorant or antiperspirant?
- 16 Why do animals huddle?
- 17 Reaction times
- 18 Hit the brakes!
- 19 Measuring the daily changes in a habitat
- 20 The break down of Casein by the enzyme protease
- 21 The break down of starch by the enzyme amylase
- 22 Osmosis
- 23 How good is my suntan cream

BIOLOGY L3

- 01 Pulse
- 02 Armchair gymnastics
- 03 Not only exercise excites the heart
- 04 Food as fuel
- 05 Citrus power
- 06 Rate of consumption of O₂ as measure of respiratory activity
- 07 Rate of production of CO₂ as a measure of respiratory activity
- 08 Temperature changes as a measure of respiratory activity
- 09 Measuring respiration (effect of temperature)
- 10 Gas production in yeast fermentation of sucrose
- 11 The uptake of oxygen as a measure of photosynthetic activity
- 12 Growth in a plant, as a measure of photosynthetic activity
- 13 Regulation of body heat
- 14 Hot stuff!?
- 15 How does sweating keep you cool?
- 16 Should I use deodorant or antiperspirant?
- 17 Why do animals huddle?
- 18/ 19 Reaction times and Hit the brakes
- 20 Measuring the daily changes in a habitat
- 21 Osmosis
- 22 The effect of temperature on membrane permeability in beetroot
- 23 Residual heat: Thermal imaging
- 24 Residual heat: Finding where a natural disaster survivor is buried
- 25 Relationship between temperature and radiated energy
- 26 How good is my suntan cream
- 27 How does photosynthetic activity vary with light intensity

- 28 Photosynthesis and respiration
- 29 Transpiration: Measuring water loss from plants
- 30 Transpiration: Measuring by mass loss
- 31 Transpiration: Differences between leaf surfaces
- 32 Transpiration: Measuring by pressure change (photometer)
- 33 Does water loss in a plant change its physical size?
- 34 Protease and casein reaction
- 35 How does enzyme activity change with temperature?
- 36 How does enzyme activity change with pH?
- 37 Change of enzyme activity with substrate concentration?
- 38 Cobalt as an inhibitor of a protease activity
- 39 Determination of the Michaelis constant
- 40 Amylase and starch reaction
- 41 How does enzyme activity change with temperature?
- 42 How does enzyme activity change with pH?
- 43 How does enzyme activity change with substrate concentration?
- 44 The breakdown of starch by the enzyme amylase
- 45 Heart beats
- 46 ECG graph demonstration
- 47 ECG Scope demonstration
- 48 Heart beats (Polar heart rate sensor)
- 49 Breathing patterns
- 50 Lung capacities
- 51 Peak Flow
- 52 Flow volume loops
- 53 Colorimetric determination of glucose concentration
- 54 Effect of glucose concentration on the colour of Benedict's solution
- 55 Acid base titration: polyprotic acids
- 56 Why does fruit brown when exposed to air?
- 57 Rate of reaction: Which catalyst is best?
- 58 The rate at which catalase breaks
- 59 The rate at which catalase breaks down
- 60 Acid base Titration: Titration of alanine with sodium hydroxide
- 61 Biology enzymes: Juice extraction from apples
- 62 Control of body temperature's response to hot and cold
- 63 Regulation of body temperature due to exercise
- 64 A womb with a view: A quick scan (model of ultrasound imaging)
- 65 A womb with a view: The whole view (model of ultrasound imaging)
- 66 Effect of sunlight on carbon dioxide levels around a plant
- 67 Carbon dioxide levels in the classroom
- 68 How does carbon dioxide vary in the environment
- 69 A model of the green house effect
- 70 How does pressure change with depth? How deep is my pond?
- 71 How tall am I?
- 72 The role of buffers in biological systems
- 73 Muscle fatigue using the Light gate
- 74 Muscle fatigue using a Force sensor
- 75 Daltons law of partial pressures
- 76 Heat transfer in a heat exchanger



SENSORS

- Digital Technology
- High Accuracy
- Robust & Reliable
- Auto Identification
- Auto Calibration
- No Batteries

THE SMARTQ DIFFERENCE

Beneath **SmartQ's** simple and bright exterior is a revolutionary architecture that dramatically enhances the intelligence, accuracy and value of our entire range of sensors. Among many of the remarkable improvements of the SmartQ design is the incorporation of a microprocessor that enables our production team to individually calibrate every single sensor digitally. You will be astounded by the accuracy and reliability of our sensors.

- | | |
|----------------------------|-----------------------|
| • Accelerometer | • Light Gate |
| • Anemometer | • Light Level |
| • Balance Adaptor | • Magnetic Field |
| • Breathing Rate Belt pack | • Motion |
| • Carbon Dioxide Gas | • Oxygen pack |
| • Charge | • pH pack |
| • Colorimeter | • Polar Heart Rate |
| • Conductivity pack | • Push Button Switch |
| • Count/Tachometer | • Rain Gauge |
| • Crocodile Clip Leads | • RF Electrosmog |
| • Current | • Rotary Motion |
| • Drop & Bubble Counter | • Sound |
| • ECG | • Speed of Sound pack |
| • Force | • Spirometer |
| • Gas Pressure | • Stethoscope |
| • Geiger Muller | • Tachometer/Count |
| • Heart Rate and Pulse | • Temperature |
| • Heat Flow | • Timing Mats |
| • Humidity | • Ultra-violet |
| • Infrared | • Voltage |





GENERAL SENSOR PACK Order No. GSP2

The General Sensor Pack offers excellent value for money, containing SmartQ sensors that cover a wide range of the most common experiments in Physics, Chemistry and Biology.

This money saving pack contains:

- 3 Temperature **Order No. 3100**
- 1 Light Level **Order No. 3120**
- 1 pH Adaptor **Order No. 3125**
- 1 pH Electrode **Order No. 2251**
- 2 Light Gates **Order No. 3250**
- 1 Voltage **Order No. 3160**

“Designed to be a starter pack for the whole science department.”

ACCELEROMETER



Low g Accelerometer

Order No. 3200

RANGES:

- $\pm 2.5g$ 3 axis (xyz)
- $\pm 10g$ 3 axis (xyz)
- $\pm 25ms^{-2}$ 3 axis (xyz)
- $\pm 100ms^{-2}$ 3 axis (xyz)

High g Accelerometer

Order No. 3201

RANGES:

- $\pm 40g$ 2 axis (xy)
- $\pm 400ms^{-2}$ 2 axis (xy)

The accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or dynamic - caused by moving or vibrating the accelerometer.

There are 2 accelerometer sensors, one recording accelerations to a maximum of 10g and one recording accelerations to a maximum of 50g.

The lower range sensor can record in acceleration in one of 3 axis or the resultant force of the 3 axis. It will also measure vibration forces and angle. The higher range sensor is restricted to 2 axis and resultant forces of both axis. Both sensors will show the acceleration as multiples of g or as m/s^2 .

Ideal Companion:

- **Dynamics System** see page 16



BALANCE ADAPTOR FOR THE SCICHEM SL AND OHAUS® TRAVELER® Order No. 3065



Only for SciChem models:

- SL500
- SL1500
- SL3000
- SL6000

Only for Ohaus Traveler models:

- TA152, 303, 301, 501, 1501, 3001, 5000

This adaptor, when connected to the SciChem SL or Ohaus Traveler Top-Pan Balance, measures and records changes in mass.

This opens up opportunities to measure another variable as well as mass e.g. temperature.



Typical Investigations:

- Measuring reaction rates where a gas is evolved e.g. acid and marble chips
- Showing the increase of mass as a solute is added to a solvent e.g. salt to water
- Studying evaporation e.g. during crystallisation
- Loss of mass from a burning spirit lamp/candle
- Monitoring transpiration

BALANCE ADAPTOR FOR THE OHAUS® SCOUT PRO Order No. 3060

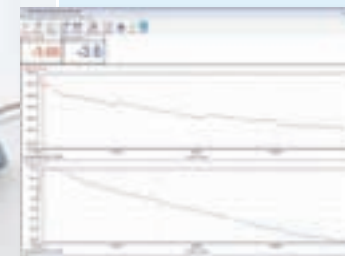


Only for Ohaus Scout Pro models:

- SPU202, 401, 402, 601, 2001, 4001, 6000

This adaptor, when connected to an Ohaus Scout Pro Top-Pan Balance, measures and records changes in mass.

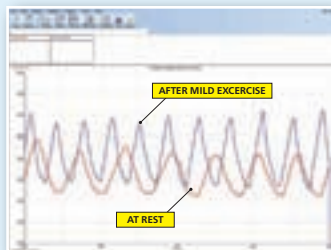
This opens up opportunities to measure another variable as well as mass e.g. temperature.



BREATHING RATE BELT PACK Order No. 3190PK

The SmartQ $\pm 10\text{kPa}$ Differential Gas Pressure sensor (3139) and Breathing Rate belt (3190) are used together to measure the expansion and contraction of a person's chest while they breathe.

The Breathing Rate Belt is wrapped around a person's chest region. Fitted inside the Belt is an inflatable air bladder, which is moulded to two rubber tubes. One of these tubes finishes with a hand pump bulb that is used to inflate the air bladder. The other tube is attached to the Gas Pressure Sensor which monitors the change in pressure during breathing.



3190PK includes:

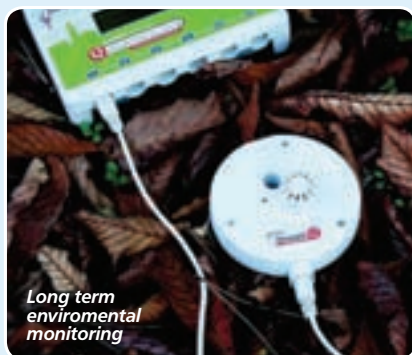
Breathing Rate Belt
Order No. 3190

Gas Pressure Differential
Order No. 3139

RANGE:
 $\pm 10\text{kPa}$



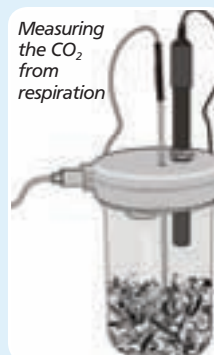
CARBON DIOXIDE Order No. 3152



This sensor demonstrates that packaging does make a difference. The upper circular lid casing has been cleverly designed to form sealed chambers using standard laboratory beakers and conical flasks.

The casing also provides self-sealing ports for inserting additional sensors into the chamber such as temperature, pH, and O_2 . The actual sensing element resides in a vented capsule that protrudes from the lower side of the sensor.

The sensor can be set at two ranges enabling measurements from a wide variety of sources.



2 RANGES:

- 0 to 10,000ppm
- 0 to 100,000ppm

Applications Include:

- Variances in classroom CO_2 levels
- Plant photosynthesis and respiration
- Respiration of small organisms e.g. microbes, maggots
- Measuring human CO_2 production
- Candle in Bell Jar (measuring CO_2 emissions)



COLORIMETER Order No. 3275

Applications Include:

- Enzyme concentration versus rates of protein, starch and fat breakdown
- Enzyme inhibition
- Lambert Beers law
- Acidic breakdown of sodium thiosulphate
- Quantitative analysis of sugar

This cleverly designed, self-contained sensor produces consistently excellent results and will appeal to the Biologist and Chemist. Any reaction that causes a change in opacity, or gives a colour change can be used to study rates of reaction.

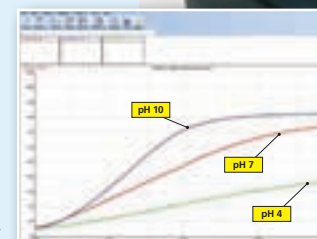
It is supplied with four 35 mm slides (red, orange, blue and green) that produce light of a specific and consistent wavelength, and a pack of cuvettes with lids.

The sensor's thick, black casing ensures that colorimetric results are not affected by ambient light.



RANGES:

- 0 to 110% Transmittance
- 0.0500 to 1.0500 Absorbance



Effect of pH on Protease activity





CONDUCTIVITY PACK Order No. 3135PK

3135PK includes:

Conductivity Adaptor

Order No. 3135

RANGES:

- 0 to 100 μ S
- 0 to 1mS
- 0 to 10mS
- 0 to 100mS

Conductivity Electrode

Order No. 3136

The Conductivity pack is both the Conductivity adaptor (3135) and the Conductivity electrode (3136).

This sensor can be set to any of four ranges enabling accurate measurements from very low ionic sources such as deionised or distilled water to very highly conductive solutions including sea water.

The electrode incorporates an in-built temperature sensor that is used to compensate for changes in the conductivity of solutions with temperature.

Typical Investigations:

- Titrations of strong versus weak acids
- Electrolytes and Non-electrolytes
- Finding the equivalence point
- Difference between ionic and molecular compounds
- Diffusion of ions through a membrane
- Environmental testing for salinity, total dissolved solids or general conductivity in water samples



CROCODILE CLIPS (PAIR) Order No. 3260

- For connecting to 'home made' switches

A Crocodile clip lead is a one metre length lead, which ends in a pair of crocodile clips.

When the crocodile clips are not connected the circuit is open (OFF). When they are connected the circuit will be closed (ON).

A Crocodile clip lead is normally used attached to a home-made or commercial switch. They can be used singly or in pairs to provide timing and event monitoring/triggering.



Crocodile clips being connected to a home made pressure pad for investigating free fall.



CURRENT - DIFFERENTIAL INPUT

RANGE:

- ± 100 mA
- Order No. 3166**

RANGE:

- ± 1 A
- Order No. 3165**

RANGE:

- ± 10 A
- Order No. 3167**

There are 3 Current sensors with different ranges that measure both AC and DC, and with differential inputs these sensors can be used anywhere within a circuit and in conjunction with a Voltage sensor.

Ideal Companions:

- **Wire Coil** see page 50
- **Hand Held Dynamo** see page 21
- **Voltage** see page 50



Measuring current in an electrical circuit.

Applications Include:

- Serial and parallel circuits
- Ohm's Law - resistance in a circuit
- Electrical induction
- Battery life
- Capacitor Discharge and Recharge
- Current surge
- Solar cells
- Electrical component characteristics
- Voltage and Current relationships
- Electrolysis

DROP AND BUBBLE COUNTER Order No. 3266



This sensor offers exceptional value as it performs a dual role. In Chemistry its primary role is as a drop counter measuring accurately the volume of titrant added during a titration. However, this sensor can also be used to monitor bubbles produced during gas production from either a chemical reaction or a biological process.

When operating as a drop counter, titrant is uniformly dripped from the supplied reservoir and optically recorded. If desired, the drops can be automatically converted to a volume measurement by following a simple calibration procedure.

As a bubble counter, the sensor optically counts the number of bubbles, from either a chemical or biological source, ascending through the plastic tubing. This method is unique in that it accurately measures the range of gas production and is ideal for biological investigations.

RANGES:

- 0 to 10,000 count
- 0 to 120 cm³ volume at a drop rate from 23 to 29 drops per cm³



E.C.G. (ELECTROCARDIOGRAM) Order No. 3279

Applications Include:

- Comparing the ECG to the waveform produced by the Heart Rate Sensor
- Comparing the ECG of a rested heart to an exercised heart
- What happens to the ECG trace if a sensor lead location is changed?
- Understand the meaning and relationships of the PQRST waveforms
- Investigate the effect of mild stimulants (Caffeine)

The ECG sensor measures the electrical energy generated during a heartbeat. To record the classic PQRST wave, the sensor's three electrodes are attached to the skin of the user's forearms using disposable ECG patches.

A comprehensive user guide is available. Each sensor is supplied with a pack of 100 disposable ECG electrode patches. Fast data sampling ($\geq 50\text{Hz}$) is required when using the ECG sensor.



RANGE:

- 200 to 4,000 μV

Supplied with a pack of 100 disposable ECG electrode patches.



FORCE SENSOR Order No. 3143



The Force sensor is supplied with a 20N spring, cushioned and non-cushioned stops, and a hook. It can be clamped to a stand, or attached to the Dynamics System (3800).

The hook is used with the spring for simple harmonic motion investigations, with stretchy rubber for bungee jumping, and with a stiff wire for investigating centripetal force in a pendulum.

The cushioned and non-cushioned stops are used when investigating collisions and crumple zones, where a car or trolley on a ramp collides with the sensor.

Applications Include:

Physics:

- Simple harmonic motion
- Collision impact
- Centripetal force
- Resultant forces
- Impulse & change in momentum
- Investigating bungee jumping
- Investigating the effectiveness of crumple zones

Biology:

- Investigating tree girth (Force sensor used as a dendrometer)

RANGE:

- $\pm 50\text{N}$

The effect of crumple zones in a collision





GAS PRESSURE - ABSOLUTE

Order No. 3210

3 RANGES:

- 0 to 110kPa Absolute
- 0 to 33in Hg
- Altitude -500m to 12,000m

Order No. 3142

2 RANGES:

- 0 to 700kPa Absolute
- 0 to 100psi

This sensor measures the total pressure on a system. When the single port is left open, then the sensor measures the atmospheric pressure. However when the sensor is connected to a sealed system, then it adds the system's pressure effect (negative or positive) to the atmospheric value.

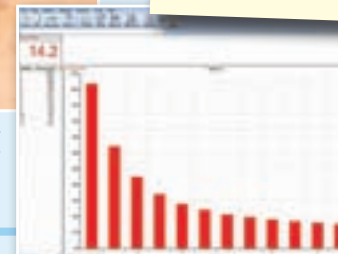
Absolute Gas Pressure can also be used as an altimeter.



A very simple way of investigating Boyle's Law. The sensor records the pressure in the plunger as the syringe is released.

Applications Include:

- Atmospheric pressure measurements
- Altimeter
- Vapour pressure of liquids
- Gas Laws



GAS PRESSURE - DIFFERENTIAL

Order No. 3139

RANGES:

- ± 10 kPa
- ± 1.5 psi

Order No. 3141

RANGES:

- ± 200 kPa
- ± 30 psi

These sensors measure the differential pressure between its two ports. If one port is open to the atmosphere then the sensor measures pressure relative to the atmospheric pressure. With both ports open to the atmosphere, the reading is zero. Blowing into one port will produce a positive value, whereas blowing into the other port will produce a negative value.

The 3139 sensor has a very sensitive range and is suitable for a number of biology experiments e.g. as a manometer, investigating the uptake of oxygen by maggots or breathing rate. For breathing rate investigations this sensor is connected to a Breathing Rate Belt (3190).

Applications for 3139:

- Experiments involving a Manometer
- Breathing rate (with Breathing Rate Belt 3190)
- Production of gases in an enclosed atmosphere during photosynthesis of an aquatic plant
- Osmosis investigations
- Rate of Transpiration investigations

Applications for 3141:

- Temperature/volume relationships
- Boyle's Law (pressure vs. volume)
- Rates of reaction where a gas is evolved



GAS PRESSURE ACCESSORY KIT Order No. 3138

The pack contains a selection of tubing elements and valves which will allow the user to make gas tight connections to a SmartQ Gas pressure sensor.

Accessory kit being used with a Pressure and Temperature sensor to investigate Charles Law.



This pack contains:

- 1x 1 m PVC tube - 3 mm bore x 1 mm wall thickness
- 1x 1 m of nylon pneumatic tube - 4 mm O.D x 2.5 mm I.D
- 4x Large pipette tip
- 4x Small pipette tip
- 1x Straight push fit connector
- 1x Tee piece push fit connector
- 2x 3-way stop cocks
- 1x 20 ml Syringe

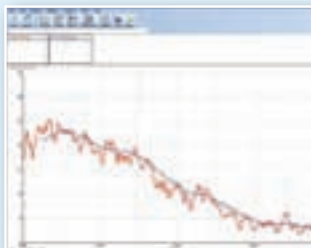
GEIGER MULLER Order No. 3265

Applications Include:

- Half life Random events
- Radioactivity exposure due to natural radon

Housed in a robust casing this self-contained sensor detects radiation from Alpha, Beta and Gamma particles.

The Geiger Muller sensor is very simple to use, as it does not require an external power source, deriving its power from the EasySense unit.



Radioactive decay of Protactinium

RANGES:

- 0 to 10,000 counts per second
- 0 to 65,535 accumulative count with zero reset
- 0 to 100% pulse output



HEART RATE & PULSE WAVEFORM Order No. 3147

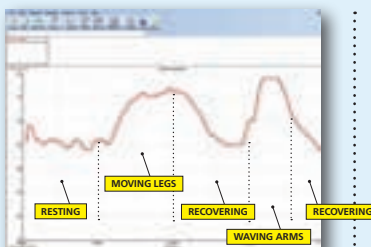
Applications Include:

- Heart rate changes due to activity
- Recovery rate
- Pulse rate
- Effect of food (chocolate) or mild stimulants (caffeine)
- Effect of music on pulse rate
- The effect of the strictest teacher entering the room!

Pupils of all ages are keenly interested in how physical and mental stress affects their heart rate. The sensing clip (pleth) can be attached to a finger or ear lobe to measure either blood flow (pulse waveform) or heart rate (beats per minute).

It works best if the test subject keeps the finger with the sensing clip absolutely still.

Note: To monitor strenuous activity, see the Polar Heart Rate sensor.



Heart Beats: Changes due to mild activity.

RANGES:

- 0-200 Beats per minute
- $\pm 2000\text{mV}$ Waveform



HEAT FLOW Order No. 3150

Rather than simply measuring surface temperature, this sensor measures the energy transfer from or to an object in Watts per square meter.

When the sensor is placed against a flat surface, the differences in the rate of temperature changes between the two sides of the sensor are used to determine the flow of heat. Objects warmer than their environment show a positive heat flow, whereas those cooler show a negative value.

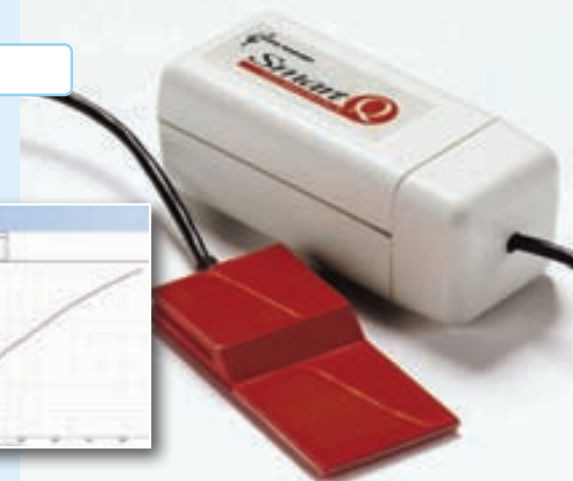
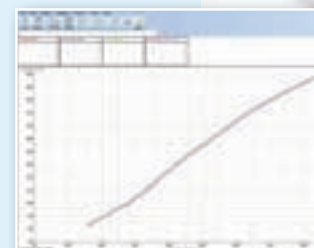
Applications Include:

- Investigating insulation properties
- Newton's Law of cooling
- Heatflow to cold objects
- Heatflow from hot objects
- Heat loss from the body e.g. through clothes; from different parts of the body, etc.
- Heat flow or loss in buildings e.g. through single and double-glazed windows; from different materials used for glazing; different areas of a door; different building materials.

RANGE:

- $\pm 2\text{kWm}^{-2}$

The experiment shows the relationship between differential temperature and heat flow. The linear relationship can be clearly seen showing Newton's Law of cooling i.e. the rate of cooling is directly proportional to the temperature difference.





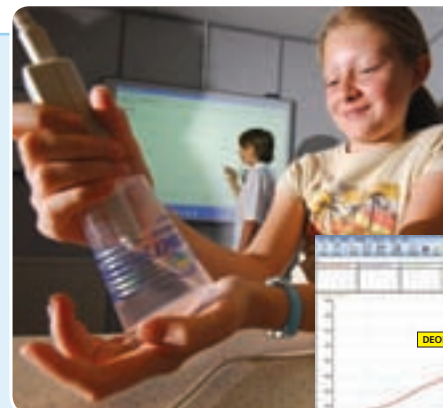
HUMIDITY Order No. 3145

RANGE:
• 0 to 100%RH

Humidity is the measure of water vapour content relative to the ambient temperature and is useful for environmental and Biology studies.

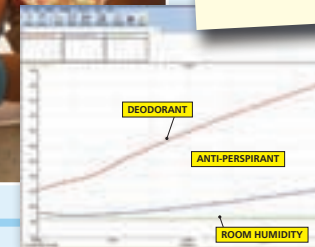
For example, a simple transpiration experiment can be set up and the results analysed in less than 5 minutes.

See page 30 for a case study of transpiration.



Applications Include:

- Water vapour expelled through the skin and breath
- Transpiration of plants
- Weather studies
- Determining dew point



INFRARED Order No. 3278

RANGES:

Radiance

- 0 to 30W/m²sr⁻¹
- 0 to 300W/m²sr⁻¹
- 0 to 3000W/m²sr⁻¹

Irradiance

- 0 to 20W/m²
- 0 to 200W/m²
- 0 to 2000W/m²

All warm objects emit infrared radiation. This sensor, therefore, can be used to detect the location of any warm item or living organism. When set to its most sensitive mode, the sensor can detect very low IR emissions, such as the heat trail left on a bench top after you move your hand away.

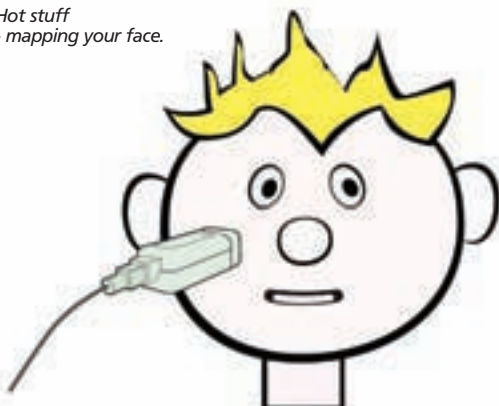
This multi-range sensor detects the energy from radiant sources from UV to Far Infrared.

The Infrared sensor adds another dimension to heat loss and energy transfer experiments, and can be seen used as a heat detector in the 'Bodies in the rubble' activity in the video clip (available on our website www.data-harvest.co.uk).

Applications Include:

- Investigating radiant energy from different surfaces e.g. heat from a Leslie's cube
- Black body studies (radiance range)
- Efficiency of insulation
- Study inverse square law - verifying that heat radiation from source is inversely proportional to the square of its distance
- Heat distribution along a metal rod
- Hershel's discovery of infrared experiment
- Investigating Stefan-Boltzmann's radiation law using a tungsten filament lamp
- Infrared in the environment
- Illustration of non-contact thermometry
- Comparing warm and cold blooded animals
- Where do we lose heat? (head, face, hands etc.)
- Locating a hot body e.g. a burnt match
- Using infrared to locate a disaster victim
- Residual heat from different surfaces e.g. finger print on worktop
- Efficiency of electric light bulbs

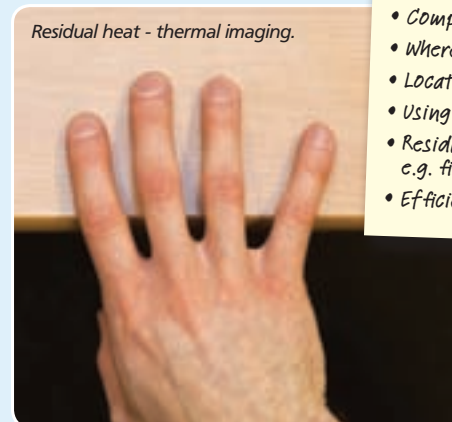
Hot stuff
- mapping your face.



Residual heat
- finding where
a natural disaster
victim is buried.



Residual heat - thermal imaging.



INTERRUPT CARD SET **Order No. 3803**

Applications Include:

- Picket fence for investigating gravity
- Other interrupt cards for time, velocity and acceleration measurements

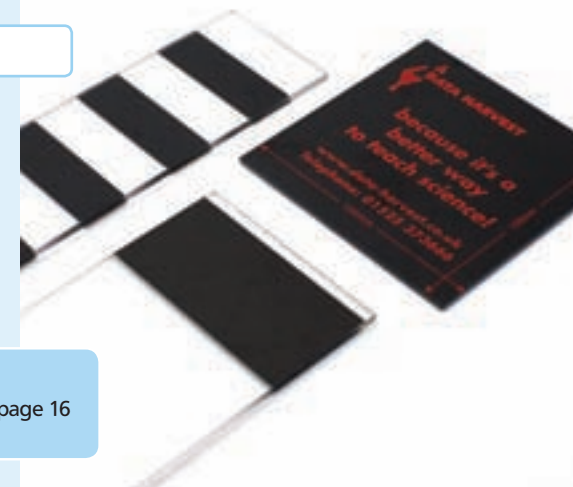
The Interrupt card set consists of 3 cards.

- A single interrupt card - a 100x100mm black plastic square.
- A double interrupt card - 180x80mm. Made from clear polycarbonate, printed with two black stripes.
- A multi-segmented interrupt card (also known as a picket fence) - 500x55mm. Made of clear polycarbonate, printed with twelve black stripes.



Ideal Companions:

- **Dynamics System** see page 16
- **Light Gates** see below



LASER MODULE **Order No. 3285**

Applications Include:

- Youngs Slit
- Optics

The laser module includes 2 optical slides for investigating diffraction gratings and Young's single and double slits.

This low cost laser module is housed in a strong plastic case and features a safety on/off switch. The laser draws its power from the Logger. It produces a red light of 645 to 665nm wavelength.

Use with the Light level sensor, the Rotary Motion sensor, the linear track from the Accessory Kit, all mounted on the Dynamics System for accurate data collection for optic experiments.

Laser mounted on the Dynamics System investigating diffraction patterns.



LIGHT GATE **Order No. 3250**



The SmartQ Light Gate is a digital switch-type sensor that has two states, ON and OFF. The Light Gate has an infra-red transmitter and receiver that detects objects passing through the 'gate'. Light Gates can be used singly or in pairs for time, speed, velocity and acceleration measurements.

Make the most of Light Gates by using them with the Dynamics System (3800), Dynamics Track (3802), and the Interrupt card set (3803).

Applications Include:

- Dynamics experiments that involve calculating time, speed, velocity, acceleration using an inclined plane or air track
- Acceleration due to gravity
- Pendulum investigations
- Measuring the time period of an oscillating body
- Impulse and change in momentum
- Centripetal force in a pendulum

Ideal Companions:

- **Spoked Pulley** see page 47
- **Dynamics System** see page 16
- **Interrupt Card Set** see above





NEW
DESIGN
2010

LIGHT Order No. 3124

RANGES:

Radiance

- 0 to 1,000 Lux
- 0 to 10,000 Lux
- 0 to 100,000 Lux
- 0 to 1k Lux Fast response
- 0 - 100% Transmission

This newly designed 5 range sensor cleverly measures light levels from 0 through to 100,000 Lux. Incorporating four sensors into one results in huge cost savings.

Three of the ranges are for general purpose use as they have filtering incorporated to eliminate the unwanted effects of modulation from room lighting (50Hz).

The fourth range has no filtering and will clearly show the modulation on an incandescent or fluorescent light. Point the sensor at a computer monitor to observe its refresh time.

Applications Include:

- Inverse Square Law
- Environmental monitoring
- Colorimeter experiments
- Yeast growth
- Absorption of light
- AC modulation



MAGNETIC FIELD

Order No. 3170

RANGE:

- $\pm 10\text{mT}$ radial and axial

Order No. 3172

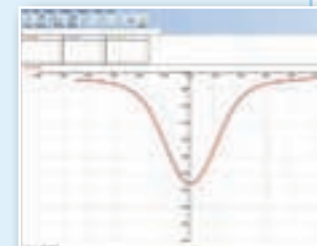
RANGE:

- $\pm 100\text{mT}$ radial and axial

Explore the nature and strengths of magnetic fields of solenoids and permanent magnets with this robust sensor which houses two switchable Hall effect transducers to measure accurately both Radial and Axial magnetic fields.

Ideal Companions:

- **Wire Coil** see page 50
- **Rotary Motion Sensor** see page 45



Variation in magnetic field strength along the axis of a coil.



MOTION SENSOR Order No. 3270

RANGES:

- 0.17m to 10m
- 17cm to 1000cm
- 7 to 400ins
- 1000 to 60000 μs

The Motion sensor can capture the motion of running students, falling basketballs and carts on inclined planes.

Featuring an industry leading sample rate of 50Hz, this sensor works well with the Dynamics System (3800).

Applications Include:

- Students running
- Simple harmonic motion
- Excellent introduction to distance/time reliability
- Newton's 2nd Law
- Elastic and inelastic collisions
- Impulse and momentum
- Speed of sound



OXYGEN PACK Order No. 3130PK**Applications Include:**

- Photosynthesis
- Cell respiration
- Enzyme activity
- Oxygen levels during breathing
- Ecosystem monitoring
- The effect of temperature on Oxygen levels
- Water quality

This pack contains both the oxygen adaptor (3130) and the oxygen electrode (3131) to form the dual range Oxygen sensor, capable of measuring oxygen levels in air, or dissolved oxygen levels in water.

**Ideal Companion:**

- Holey Cap Set Order No. 3174

2 RANGES:

- 0 to 25% O₂ in Air
- 0 to 125% DO₂ Sat

3130PK includes:

Oxygen Adaptor
Order No. 3130

Oxygen Electrode
Order No. 3131

Includes 2 spare membranes & electrolyte

**pH PACK Order No. 3125PK****Applications Include:**

- Testing acids and alkalis
- Acid-Base titrations
- Acid rain
- Dissolved Oxygen in water
- Enzyme action
- Cell respiration
- Human respiration
- Photosynthesis and respiration
- Water quality

The pH adaptor (3125) and general pH electrode (2251) combine to form the immensely popular SmartQ pH sensor pack.

The SmartQ pH sensor has both a pre-set calibration range (so the sensor is ready for immediate use) and a user calibration range.

The electrode in this pack (2251) is a general purpose plastic bodied glass non-refillable electrode, suitable for most investigations.

Alternative electrode

The 2252 pH electrode is a low conductivity water electrode. Designed for use in samples with low ionic strength such as pure water. Useful for acid rain investigations.

Ideal Companions:

- Holey Cap Set see above
- Drop Counter see page 37

RANGE:

- 0 to 14pH

3125PK includes:

pH Adaptor
Order No. 3125

pH Electrode
Order No. 2251

Alternative extra:

pH Electrode for Low Conductivity Solutions
Order No. 2252

**Applications Include:**

- Monitor heart rate before, during and after vigorous activity
- Monitor the speed at which the heart rate returns to normal following exercise (recovery rate)
- Investigate the effects of a mild stimulant such as caffeine in cola or coffee on heart rate
- Check for baroreceptor reflex: that is changes in heart rate for a person when reclined, sitting, standing or moving, caused by the heart pumping blood to different levels

POLAR HEART RATE EXERCISE SENSOR Order No. 3148

This sensor is used to monitor heart rate in beats per minute during and after exercise. It consists of a belt that is worn around the ribcage against the skin, and a SmartQ Heart Rate receiver. The heart rate information is transmitted wirelessly from the belt to the receiver, which can be up to 80 cm apart.

**RANGE:**

- 0 to 220 beats per minute

Pack Includes:

- Receiver (3148A)
- Transmitter (3272)
- (Small Belt (3273)
- Large Belt (3274)



PUSH BUTTON REACTION SWITCH Order No. 3261

One switch can be used for manual marking of events during data logging activities.

Fitted with a red LED, a pair of these switches can be used to test students' reaction times.

*Applications Include:**Physics:*

- Stopwatch, e.g. starting and stopping timing
- Introducing speed

Biology:

- Reaction times

General:

- Walking a set distance
- Recording the time taken by a vehicle to pass from one point to another



Reaction times.

RF ELECTROSMOG Order No. 3159**RANGES:**

- -60 to 0 dBm
- 0 to 6 V/m
- 0 to 100%

Applications Include:

- Mobile phones
- Microwave smog
- RF Interference

The SmartQ RF Electromog detector is a broad bandwidth RF (Radio Frequency) detector. It can detect RF over the frequency range 50 MHz to 3 GHz.

This means it is suitable for measuring the RF that comes from Bluetooth, Wi-Fi, microwave ovens and mobile phones. The detector does not distinguish the frequency of the RF source, some discrimination of frequency can be achieved with design of the antenna.

The RF Electromog detector is fitted with a female F-type connector (the type of connector used for cable and satellite aerial connections).

The F-type connector allows the user to make and attach antennae that are more specifically tuned to a particular frequency.

Investigating the RF from a communications mast.

NEW**Ideal Companion:**

- Key Fob - RF Transmitter
- Order No. 3158

Measuring RF from a mobile phone.



ROTARY MOTION SENSOR Order No. 3280

Applications Include:

Physics:

- Motion with kinetics trolley
- The study of pendulum motion
- Simple harmonic motion

When used with the Accessory Kit:

- Conservation of Angular momentum
- Moments of inertia
- Pendulum investigations
- Gravitational rotational energy
- Frictional torque
- Rotational collisions
- Rotational inertia
- Newton's Second Law in its rotational form
- Tracking movement in a circle
- Linear displacement of an object

Biology and Chemistry When used with the Accessory Kit

- Linear movement of gas syringe plunger

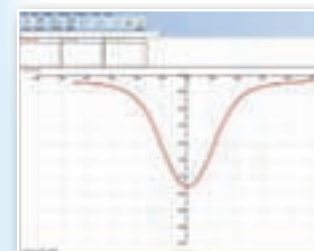
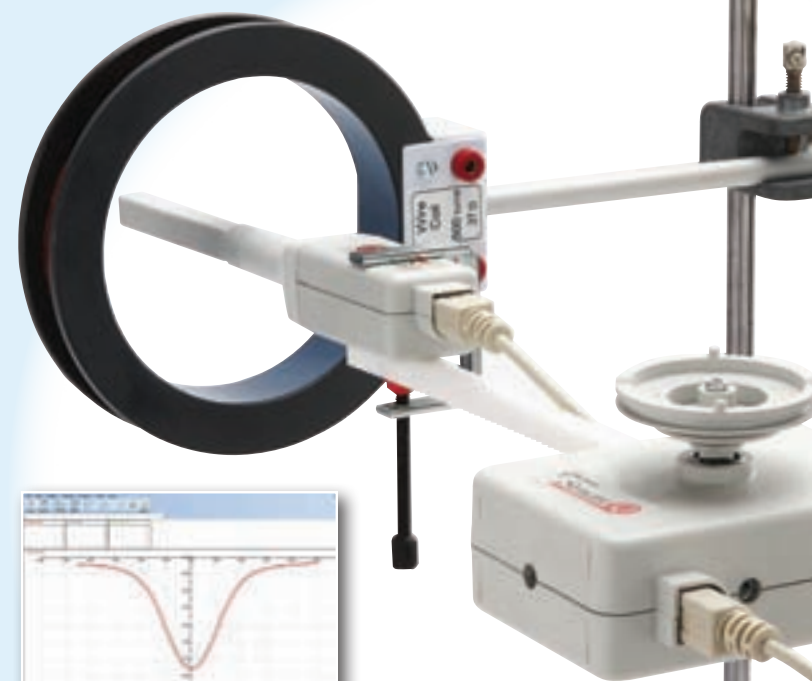
This 8 range sensor is a must for every Physics department. It is highly accurate with an extremely low friction pulley capable of measuring a variety of motions including: pendulum, angular, linear (pulley) and linear (using the Linear Rack accessory).

The sensor can be used on its own or coupled with the linear rack and another SmartQ sensor, such as Light Level, to investigate the Inverse square law and Young's Slits.

If this sensor is used for measuring motion, it is best used with the Dynamics System.

The optional accessory kit (see below) widens even further the range of investigations this sensor can achieve.

- 11mm Pulley: $\pm 200\text{mm}$ distance
- 31mm Pulley: $\pm 2000\text{mm}$ distance
- 49mm Pulley: $\pm 2000\text{mm}$ distance
- Angular Position: 0 to 360°
- Angular Velocity: $\pm 40\text{rads per second}$
- Angular Velocity: ± 4 revs per second
- Pendulum: $\pm 20^\circ$
- Linear Rack: $\pm 200\text{mm}$



Magnetic field within a coil is plotted against position.

ROTARY MOTION ACCESSORY KIT Order No. 3288



This is an optional accessory kit that comprises of:

- Pendulum with two adjustable masses.
- A 250mm plastic rack which allows for the accurate measurement of linear displacement. It can be used with a Light Level sensor and the Laser Module to accurately measure distance moved in Young's single and double slit experiments. Similarly, attaching a Magnetic Field sensor, an accurate plot of field strength versus distance can be obtained.
- Two discs for studying Angular Momentum.





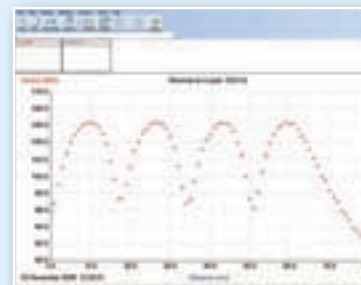
SOUND LEVEL Order No. 3175

RANGES:

- 40 to 110dBA
- Waveform $\pm 2000\text{mV}$

Useful for all age ranges, this dual range sensor accurately measures both sound pressure level in decibels (dBA) or waveform (mV).

To make the measurements meaningful to learners, the sensor has been designed to approximate the normal human ear in the range and intensity that it 'hears' sounds.



The graph shows the sound pressure levels in an open pipe when resonated at four times the natural frequency of the tube.

Applications Include:

- Sound frequency
- Speed of sound
- Sound insulation
- Sound decay
- Air resonance
- Sound waves: Monitoring the effect of altering frequency and amplitude, wave forms of musical instruments, etc.
- Ear design
- Animal activity studies
- Noise pollution indoors and outdoors



SPEED OF SOUND PACK Order No. 3179

3179 includes:

2 Stethoscope Sensors
Order No. 3176

The speed of sound pack contains two SmartQ Stethoscope sensors. The difficulty of recording the speed of sound in solids with traditional sound sensors has been with the positioning of the sensors on the test surface, involving clamp stands, sticky tape and pieces of modelling clay. The SmartQ Stethoscope sensor has a shape that allows the sensor to be placed directly onto the surface, no additional apparatus is required.

The bell structure of the Stethoscope sensor is more effective in isolating the sounds being recorded from the environment and makes collection of the data simple and repeatable. The support documentation comes complete with tested experiments and full advice on how to use the sensor.

This sensor pack requires a logger capable of fast recording.

Applications Include:

- Investigating the speed of sound through different mediums such as air, wood, metal, plastic and water.



STETHOSCOPE PACK Order No. 3176PK

3176PK includes:

Stethoscope Sensor
Order No. 3176

Conventional Stethoscope
Order No. 3178

RANGES:

- Stethoscope $\pm 100\text{mV}$
- Stethoscope F* $\pm 100\text{mV}$
- Sound $\pm 1000\text{mV}$
- Sound F* $\pm 1000\text{mV}$

The pack contains a SmartQ Stethoscope sensor and a conventional binaural stethoscope.

The Stethoscope sensor allows you to record the heart sounds and the echoes of the beat in the circulation.

With the addition of an ECG sensor and a Heart wave sensor a full physiology of the heart cycle can be recorded and analysed.



Applications Include:

- Sound level changes in a heart beat

Ideal Companions:

- **ECG** see page 37
- **Heart Rate** see page 39

* includes a low pass filter to remove high frequency noise.

SPOKED PULLEY Order No. 3177



- Produces excellent results
- A must for all physics labs

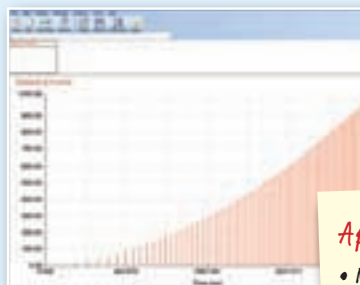
This precision 10 segment, 50mm diameter very low friction pulley attaches to either the Light Gate, Rotary Motion sensor or directly to the Dynamics System where it can be used for the continuous recording of time/distance, time/velocity and time/acceleration relationships.

Ideal Companions:

Light Gates see page 41

Rotary Motion sensor see page 45

Dynamics System see page 16



Motion down an inclined plane.

Applications Include:

- Motion detection
- Atwoods engine



SPIROMETER Order No. 3267



The Spirometer measures air flow whilst the user breathes. The air flow data can be converted to volume using a simple function in the EasySense software.

The Spirometer comes with 1 nose clip and 4 flow head filters - one 'fixed' and three for test subjects. A flow head contains an antibacterial and antiviral filter to lessen the possibility of cross contamination between subjects. The flow head is for a test subjects use only and should be regarded as a 'disposable' item. A circular guard is provided to prevent the 'fixed' flow head being used.

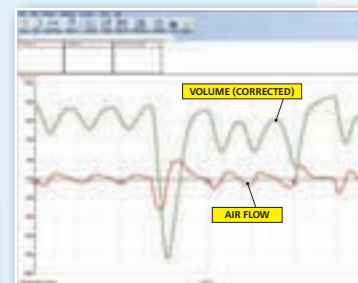
Replacement parts are available: Pack of 10 replacement flow head filters (3269) and pack of 5 nose clips (3264).

RANGE:

- ± 10.0 litres/second

Includes:

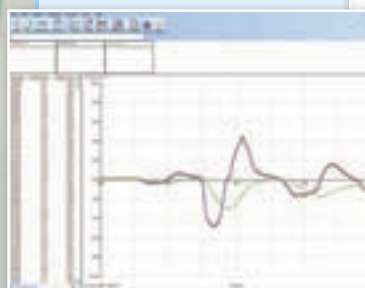
- 4x flowhead filters
- 1x nose clip
- 1x circular guard



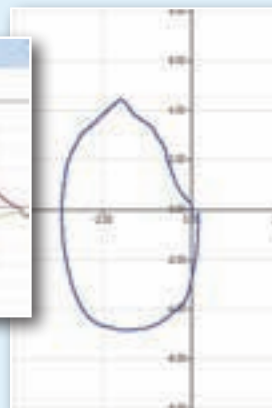
Lung capacity.

Applications Include:

- Lung capacity
- Fitness profiling
- Flow volume loop



Flow from the Spirometer with lung volume being derived by the Post Log function 'Spirometer flow to volume'.



Flow volume loop is achieved by plotting flow rate against volume.

An improvised weather station using the Count Tachometer with the Rain Gauge and Anemometer connected to a data logger for long term recording.

COUNT/TACHOMETER ADAPTOR **Order No. 3296**



Offering a wide variety of modes, the Count/Tachometer adaptor will accept any Data Harvest SmartQ digital sensor e.g. light gate, crocodile clips, push button switches via the din plug connector. For added versatility a 3.5 mm jack plug can be used to connect any switch e.g. a magnet and reed switch or a foot switch

To make life simple we have selected some accessories to give immediate results, an anemometer to measure wind speed in miles per hour or metres per second, a rain gauge to measure rainfall in mm.

Applications:

Use the Count/Tachometer sensor to:

- measure distances and speed of a road bicycle
- attach an anemometer and rain gauge to make the core of a logging weather station
- Use push switches to count events
- study circular motion
- use it to act as trigger for other sensors e.g. start recording once the door is opened

RANGES:

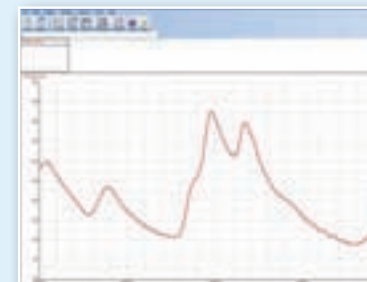
- Cumulative counts 0 - 1000
- Cumulative counts 0 - 60000
- Counts per second
- Revs per minute
- Revs per second

Ranges dedicated to accessories:

- Wind speed using the anemometer (m/s)
- Wind speed using the anemometer (mph)
- Rain gauge - 1 mm per tip
- Speed with spoked pulley (in m/s)
- Speed with spoked pulley (in mph)
- Distance with spoked pulley (in m)

- **ANEMOMETER with Count/Tachometer adaptor**
Order No. 3297PK

- **ANEMOMETER** **Order No. 3297**



Typical graph monitoring wind speed.

- **RAIN GAUGE with Count/Tachometer adaptor**
Order No. 3298PK

- **RAIN GAUGE** **Order No. 3298**



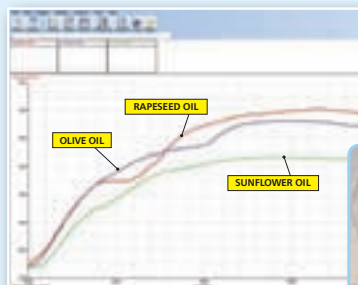
Applications Include:

- Cooling rates
- Absorption of energy
- Solar energy
- Insulation investigations
- Animal behaviour
- River and pond studies
- Freezing and melting of water
- Energy content of foods
- Change of state
- Neutralisation reactions
- Greenhouse effect
- Fractional distillation
- Vapour pressure of liquids
- Habitats
- Pond and river studies

TEMPERATURE - GENERAL PURPOSE Order No. 3100

This general purpose Temperature sensor is the most commonly used sensor in the range. It can accurately measure the temperature of air, water, soil and weak acidic solutions, making it indispensable in all Science Departments.

Housed in stainless steel tube that is resistant to dilute acids.



Food as a fuel: Comparing the energy provided by 3 different cooking oils.

**RANGES:**

- -30°C to +110°C (Resolution 0.1°C)
- -22°F to 230°F

**TEMPERATURE - FAST RESPONSE Order No. 3101****Applications Include:****Biology:**

- Skin surface temperatures e.g. body mapping, changes due to exercise.

Chemistry:

- Universal gas laws

This sensor is extremely responsive as it features an exposed thermistor. It is ideal for determining changes in skin temperature, or for measuring air temperature in tight spaces.



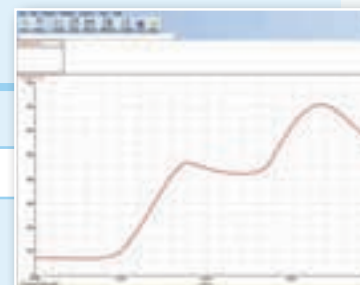
This temperature probe is ideal for measuring the temperature in confined spaces. Here it is shown in a Charles Law experiment.

RANGES:

- -30°C to +110°C (Resolution 0.1°C)
- -22°F to 230°F



Temperature profile of a bunsen flame.

**Applications Include:****Physics:**

- Profile of a Bunsen flame
- Comparing the temperature of different flames e.g. candles
- Melting point of copper, bismuth or other solids

Chemistry:

- Temperature of dry ice or liquid air

General:

- What temperature does popcorn pop?

TEMPERATURE - HIGH RANGE Order No. 3105

The wide temperature range of this sensor enables it to be used in a variety of experiments e.g. melting points and flame profiles.

The thermocouple junction is housed at the end of a 200 x 3 mm AISI 310 stainless steel sheath. It has a one meter long cable that terminates in a mini plug (colour coded green to indicate thermocouple 'type K').

The metal sheath of the thermocouple can withstand temperatures above 1,000°C. However, the PVC insulation on the connecting cable has a working range of -10°C to 105°C, so keep this cable away from the source of heat e.g. by clamping the sensor in position. Stainless steel 310 was selected as the material for the sheath for its properties as a poor conductor of heat.

RANGE:

- -200°C to +1,000°C

Includes:

K-Type Thermocouple Adaptor

Order No. 3105A

K-Type Thermocouple Probe

Order No. 3107





TIMING MATS (PAIR) Order No. 3255

- 2 Timing Mats (58cm x 17cm in size)

These large mats (58 cm x 17 cm) are on/off switches, and are activated by stepping onto them; one mat starts the timer, the other stops the timer.

A favourite activity for younger children is to find out how long they can stay in the air when they jump.



Applications Include:

- How long can I stay in the air when I jump?
- How fast can I hop, walk, and run?
- How many jumps can I do in a minute?



ULTRA-VIOLET Order No. 3277

RANGES:

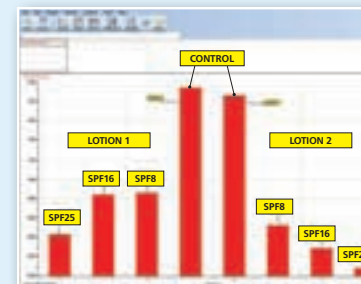
Slow Response:

- 0 to 50W/m²
- 5W/m²
- 500mW/m²

Fast response:

- 0 to 50W/m²
- 5W/m²
- 500mW/m²

This multi-range sensor is sensitive to both UVA and the harmful UVB band of the spectrum, and allows topical investigations into the efficiency of suntan creams, UV protection of clothes etc.



Investigating the efficiency of sun creams in their ability to screen ultra-violet light.

Applications Include:

Physics:

- UV protection of clothing
- Investigating the UV variations along a fluorescent tube v light output

Biology:

- Testing suntan creams and sunglasses

Chemistry:

- Fluorescent rocks and dyes

Environment:

- Investigating the effect of cloud cover on UV measurements



VOLTAGE - DIFFERENTIAL INPUT Order No. 3161

RANGES:

Order No. 3162

- $\pm 1V$

Order No. 3161

- 0 to 10V

Order No. 3160-12

- $\pm 12V$

Order No. 3160

- $\pm 20V$

There are 4 Voltage sensors that measure the potential energy across any component for both DC and low voltage AC circuits. The 4mm plugs attach to most of the standard available electronic kits. With differential inputs, these sensors can be used anywhere within a circuit.

Ideal Companions:

- Wire Coil see adjacent
- Hand Held Dynamo see page 21
- Current Sensor see page 36



WIRE COIL Order No. 3173

Supplied with magnet

Applications Include:

Physics:

- Series and parallel circuits
- Current and voltage relationships
- Resistance
- Electrical characteristics
- Induced emf (3162 only)
- Battery comparisons
- Capacitor charge/discharge
- Ohm's law

Environmental:

- Alternative sources of energy



Make the most of your investment:

Visit our web site: www.data-harvest.co.uk

- Free downloads of every manual, for every Data Harvest product
- Free software updates
- Free worksheets
- Newsletters (with special offers)
- Hints & tips (FAQ's)
- Exam Syllabus matches
- Even a lively forum where you can ask questions and engage with other teachers

Data Harvest

Based in Leighton Buzzard, Bedfordshire, UK. Data Harvest is a team of dedicated and highly skilled people: electronic design engineers, software programmers, technicians, production & dispatch personnel, customer support staff, administrators and the sales and marketing team.

- We believe that the use of technology enhances and transforms science education.
- We believe that using technology saves time and raises standards.
- We are dedicated to continually improving our products and services.
- We produce educationally relevant and affordable solutions.

All Data Harvest products, are designed, developed and manufactured in the UK.



Contact us

Sales Office	Suzanne Guess	01525 373666	sales@data-harvest.co.uk
England			
North	Barbara Higginbotham	01525 373666	barbara.higginbotham@data-harvest.co.uk
South West	Iain Davison	07841 087669	iain.davison@data-harvest.co.uk
Midlands	Lee Grahame	01525 373666	lee.grahame@data-harvest.co.uk
London & South East	Saba Tyson	07734 257350	saba.tyson@data-harvest.co.uk
Scotland	Barbara Higginbotham	01525 373666	barbara.higginbotham@data-harvest.co.uk
Northern Ireland	Barbara Higginbotham	01525 373666	barbara.higginbotham@data-harvest.co.uk
Wales	Iain Davison	07841 087669	iain.davison@data-harvest.co.uk



Iain
Davison



Suzanne
Guess



Barbara
Higginbotham



Lee
Grahame



Saba
Tyson

Data Harvest Group Ltd, 1 Eden Court, Leighton Buzzard, Beds, LU7 4FY. UK
Tel: +44 (0) 1525 373666 • Fax: +44 (0) 1525 851638
sales@data-harvest.co.uk • www.data-harvest.co.uk

