Engaging with Science

DATA HARVEST

VENTUS
Ciencia Experimental

ISSUE 3

Contents

DEMONSTRATION ASSISTANCE

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

TRAINING & SUPPORT

We offer training not simply at the time of purchase; we understand that schools sometimes need 'refresher' courses. Contact us whenever you need updating.

Free training and support for the lifetime of the product!

COMMITMENT & EXPERIENCE

For over 31 years Data Harvest has designed, manufactured, marketed and supported all of its products here in the UK.

We work exclusively in the Education sector.

AWARD WINNING PRODUCTS & SERVICE

We are proud of our success over the years gaining many awards for developing and supplying our high quality products, an exemplary service to the UK and Export education markets.

- BETT Award
- ERA Award
- World DIDAC Award
- Practical Pre-school Award

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

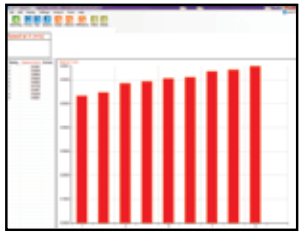
EasySense | Software

Simple, fully featured, powerful

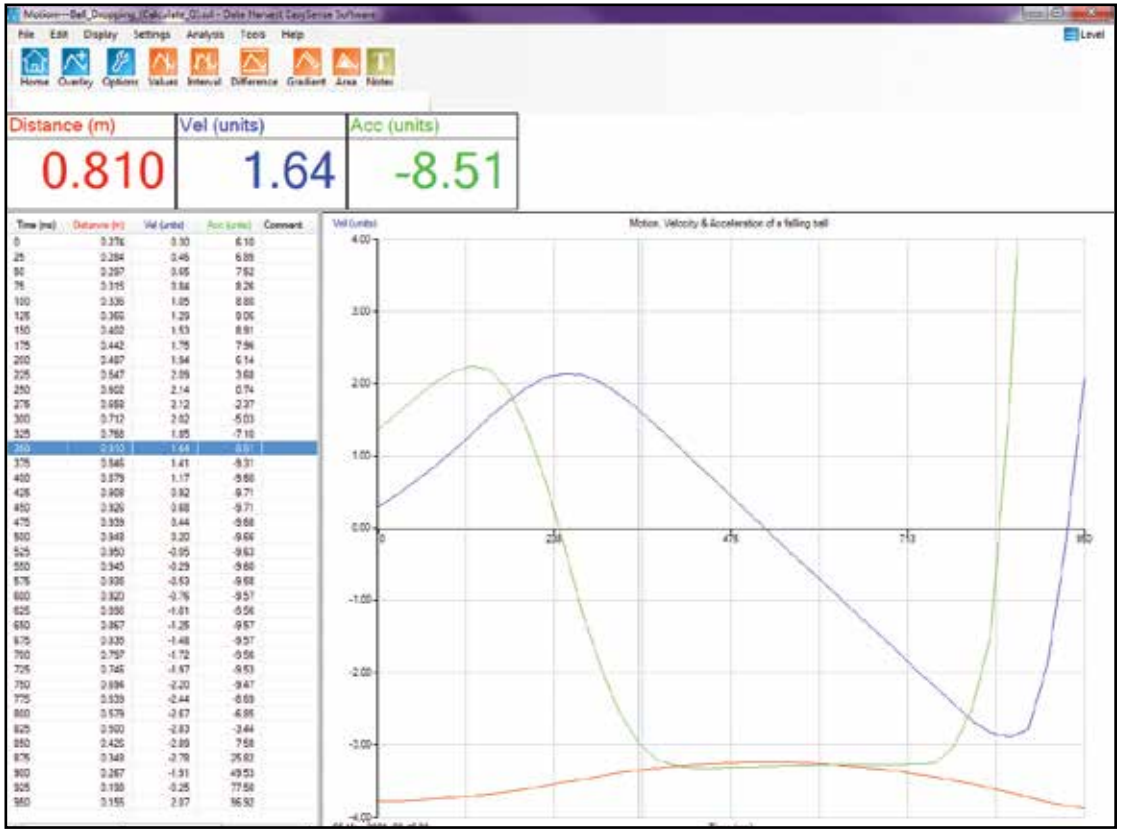
BETT AWARDS WINNER

Pictograms

Meters



Bar Graphs



Line Graphs

iPad EasySense

Enhance your data logging experience with our iPad iOS software and one of our Wi-Fi enabled data loggers for full classroom collaboration and data sharing.

EasySense | Multi-platform

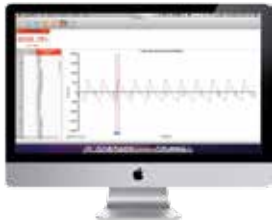
Windows PC, Apple Mac and iPad

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.

Download the free EasySense software site licence.

Windows



OS X

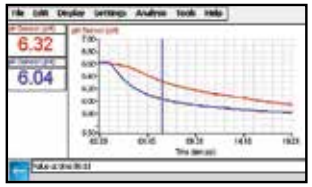
iOS

VISION Data Logger

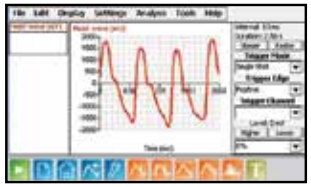
With the EasySense software built in - No PC required!

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.

See page 9



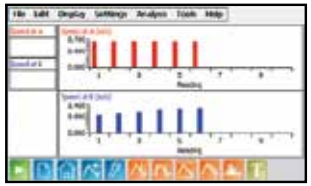
EasyLog/Graph



Scope

Meters

Snapshot



Timing

Setups

EasySense Features:

Graph options
- Line
- Bar
- Table
- Overlay

Analysis tools
- Area under the curve
- Gradient
- Values
- Interval

Timing options
- Time
- Velocity
- Acceleration

Fast Logging
Cut and Paste
Print
Save
Auto scale
Set sensor axis limits
Selection Wizard
Use Selection
Pre-Trigger
Smooth
Continuous Logging
Title graph
Zoom
Export Data

Features may vary across platforms.

EasySense | Collaboration

Enhance learning, make full use of technology in the classroom

Capture data with the EasySense range of Data Loggers connected to your PC, Mac or iPad, and in real-time share the data with other network users.

The multi-platform EasySense software allows the simultaneous sharing of data as it is captured across a range of devices.

Currently covering PC, Mac & iPad this major new feature simplifies sharing of data between small student groups and entire classes.

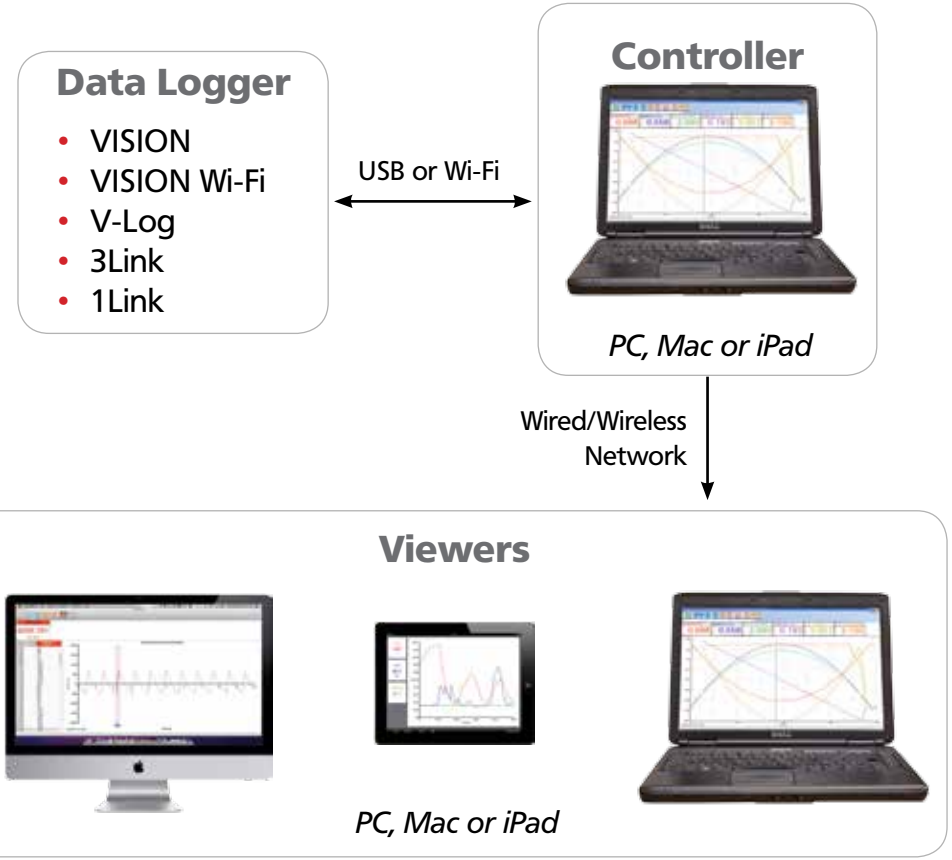
Catch Up Mode

If a Viewer connects to a Controller, after an experiment has completed, the currently displayed experiment will automatically be transferred in full to the viewer.

This feature allows a student to 'catch up' if they missed the experiment as it happened. It can also be used to quickly ensure that all students have the same set of data to work with.

How it works...

- An EasySense logger is connected to a Controller.
- The data is captured in real-time and instantly relayed to all of the Viewers connected via the controller and local network.
- At the end of the experiment, the Controller and every Viewer has its own set of data, ready for analysis and reporting.



Engage, Empower and Enhance...

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.

- 4 SmartQ Sensor inputs
- 2 SmartQ Digital inputs for Time, Velocity & Acceleration experiments
- Fast data logging for Physics (Up to 50,000 samples per second)
- Long term remote data logging
  (Up to 14 days logging on a single battery charge)
- USB Client: Mouse, Keyboard, Memory Stick, Printers.
- 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
- Battery life: A full 'classroom day'
  (User replaceable rechargeable Lithium-ion)
- High resolution full colour touch screen with
  fast response to stylus or finger
- EasySense software built-in, looks and
  behaves the same as the PC version
- Optional Wi-Fi version available

Order Code: 2020

WINNER BETT Awards 2011

"Quick, effective, space saving, self contained"

VISION | With a Computer

Connect VISION to a Computer, and you can:

- Use VISION as an interface and control it from the PC, Mac or iPad Great for whole class demonstrations
- Data captured on VISION can be transferred to the Computer and opened directly into EasySense software
- VISION to Computer connection is simple and straight forward using either a USB cable or Wi-Fi

VISION | With a Projector

Simply connect VISION's VGA output to a Projector (or monitor) and the display automatically switches from VISION's LCD to the connected display.

Using a projector allows student groups to quickly share and discuss results with the entire class. It is also perfect for training sessions and presentations of teacher led experiments.

VISION | With a Printer

Connect VISION to a suitable HP (PCL) printer to print the experiment Graph or Data Table directly.

Use print outs to document and report experiments without having to transfer the data to a PC first.

Charging Bay **Order Code: 2037**

Designed to store and re-charge up to 4 VISIONs simultaneously from a single plug charger (supplied)

The bay is designed to be used on a bench or inside a standard Gratnells tray.

VISION | Standalone

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

Windows

VISION is a comprehensive datalogger, offering all the features you would expect:

- General purpose classroom data logging
- Fast logging for Physics
- Long term recording for Biology & Environmental experiments
- VISION offers a full colour high resolution LCD touch screen
- Graphing and analysis tools
- Print out the graph (VISION is compatible with a wide range of HP PCL Printers).
- Large user memory for storing data files
- Captured data can be transferred to a computer by USB, Wi-Fi or via a pen drive

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 Wi-Fi

All the features of the award winning VISION data logger plus wireless network connection to iPad & PC.

Windows iOS

Captured data can be wirelessly transmitted around the class for group discussion.

See page 7 for details of the class collaboration feature

Order Code: 2021

Multi-Buy Packs

Save on the standard purchase price with our 5 pack VISION and VISION Wi-Fi data loggers.

5 VISION Data Loggers

Order Code: 2020PK5

5 VISION Wi-Fi Data Loggers

Order Code: 2021PK5

V-Log | Data Logger

5 Packs Save 10%

The V-Log data logging range offers a cost effective solution without compromising on features and performance.

V-Log^4

V-Log^4 is a cost effective logger for use with PC and iPad (requires Wi-Fi Version).

V-Log4 offers:

- 4 SmartQ sensor inputs
- Large LCD Display
- 14 Days Remote logging
- Built-in rechargeable battery pack
- Fast logging (50,000 samples per second)
- Memory to store multiple recording sets
- USB Connection
- Logging Modes
  - EasyLog
  - Snapshot
  - Fast Logging
  - Remote Logging
  - Timing

V-Log^8

The V-Log^8 data logger offers all the features of V-Log^4 plus 4 additional built-in sensors.

- Light
- Sound
- Humidity
- Air Pressure

Windows iOS

Wi-Fi Module

Optionally all V-Log models can be supplied with a Wi-Fi module fitted. This allows V-Log to communicate with PC and iPad wirelessly.

The module can also be purchased later and plugged into the V-Log to add Wi-Fi functionality.

2404PK	**V-Log^4 USB**	**(5 pack 2404PK5)**
2405PK	**V-Log^4 USB + Wi-Fi**	**(5 pack 2405PK5)**
2408PK	**V-Log^8 USB**	**(5 pack 2408PK5)**
2409PK	**V-Log^8 USB + Wi-Fi**	**(5 pack 2409PK5)**
2401	**Wi-Fi Module**	

Interfacing | Low-cost PC Solutions

Classroom based data capture

- Fast logging (50,000 samples a second)
- Powered from the USB port.
- Supplied with the EasySense software.

3Link

EasySense 3Link offers a convenient option for students to directly connect up to 3 SmartQ sensors to a PC.

5 Packs Available

Windows

Pack Includes:

1 x 3Link Interface
2 x Long Sensor Lead
1 x Short Sensor Lead
1 x EasySense Software Site licence
1 x USB Lead
1 x Storage Case

Order Code: 5540 • 5 pack 5540PK5

1Link

1Link is an exceptionally low cost interface and is ideal for those applications that require only one sensor.

Windows

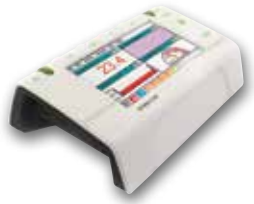
Pack Includes:

1 x 1Link Interface
1 x Long Sensor Lead
1 x Mini USB Lead
1 x EasySense Software Site licence

Order Code: 5530

Comparison Chart | Features

Classroom based data capture



	VISION	VISION Wi-Fi	V-Log⁴	V-Log⁸	3Link	1Link
SmartQ Sensor Inputs	4	4	4	4	3	1
Built-in Sensors	None	None	None	Light, Sound, Humidity, Air Pressure	None	None
Remote Recording	14 Days	14 Days	14 Days	14 Days	-	-
Rechargeable Battery Pack	Yes	Yes	Yes	Yes	No	No
USB	Yes	Yes	Yes	Yes	Yes	Yes
Wi-Fi	No	Yes	Optional	Optional	No	No
VGA Out	Yes	Yes	No	No	No	No
Screen	Graphical Colour Touch Screen	Graphical Colour Touch Screen	8 Line Graphical	8 Line Graphical	No	No

Engaging with Physics

Many physics experiments occur very quickly, often in milliseconds or even micro-seconds. Using the fast capture features really does make the invisible visible. As with all Data Harvest loggers, experiments are accurate, reliable and repeatable.

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.

Physics (11-14)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

1 x L2 Physics eBook
2 x Push Button Reaction Switch
2 x Temperature Sensor
2 x Light Gate
3 x Current - 100mA
1 x Current - 1A
1 x Current - 10A

Order Code: CSP005

eBook

L2 PHYSICS

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 | Curriculum Packs

Light, Sound & Pressure (14-18)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

1 x L3 Light, Sound & Pressure eBook
1 x Gas Pressure - Absolute 700kPa
1 x Gas Pressure - Differential 200kPa
1 x Infrared
1 x Light Level
1 x Sound Level
1 x Speed of Sound Pack

Order Code: CSP006

eBook

L3 Light, Sound & Pressure

01 Reflectivity
02 How does the intensity of light change with the distance from the light?
03 Polarised sunglasses
04 Investigating interference
06 Infrared in the spectrum
07 An experimental estimation of Planck's constant
08 Fast light
09 The Biq 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 Boyles 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
24 Voice recognition

Electricity & Heat (14-18)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

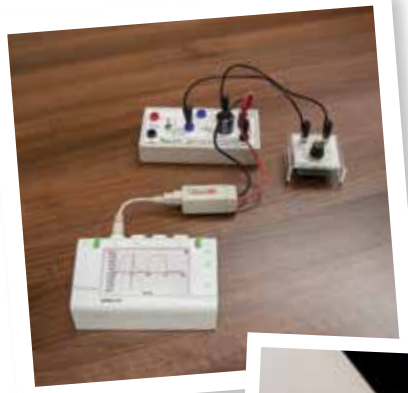
1 x L3 Electricity & Heat eBook
2 x Voltage - Differential 12V
1 x Magnetic Field - 10mT
2 x Temperature Sensor
3 x Current - 100mA
1 x Current - 1A
1 x Current - 10A

Order Code: CSP007

eBook

L3 Electricity & 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



Motion & Forces (14-18)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

1 x L3 Motion & Forces eBook
1 x Rotary Motion Accessory Kit
1 x Rotary Motion Sensor
1 x Force Sensor
2 x Light Gates

Order Code: CSP003

eBook

L3 Motion & 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

Dynamics (11-18)

A curriculum pack that includes sensors, dynamics system and curriculum materials.

Pack Includes:

2 x Light Gates
1 x Rotary Motion Sensor
1 x Dynamics System

Order Code: CSP004

Dynamics Curriculum Materials

PART ONE: Using the Dynamics System
Motion: Using Light Gates on a slope to measure speed or acceleration
Motion: Measuring motion up and down a slope using a Motion Sensor
Motion: Measuring motion up and down a slope using a Rotary Motion Sensor
Motion: Using a Light Gate and Spoked Pulley
Gravity: Using a single Light Gate to measure g
Gravity: Using a single Light Gate to measure g by logging the velocity after falling a known distance (d)
Gravity: Using two Light Gates to measure g
Gravity: Using a Motion Sensor to measure g by free fall
Gravity: Using a Light Gate and 'picket fence' to measure g
Gravity: Using a Motion Sensor with a rolling cart to measure diluted gravity
Forces: Motion with balanced forces
Forces: Using two Light Gates to investigate forces e.g. Newton's 2nd Law
Forces: Using a Motion Sensor to investigate forces e.g. Newton's 2nd Law
Forces: Using a Rotary Motion Sensor to investigate forces
Forces: Using a Light Gate and Spoked Pulley to investigate Newton's 2nd Law (Atwood's Machine)
Forces: Using a Force Sensor to investigate static and dynamic friction
Pendulum: Using a Rotary Motion Sensor for simple pendulum investigations

PART TWO: Using the Extension Kit 1
Motion: Using the spring to roll a cart up a slope
Pendulum: Using a Light Gate and a simple pendulum
Collisions: Using two Motion Sensors with magnets
Collisions: Using two Motion Sensors with springs
Collisions: Using two Light Gates with magnets
Collisions: Using two Motion Sensors and a Force Sensor
Collisions: Using a Force Sensor and a Light Gate
Collisions: Using a Force Sensor and a Light Gate to investigate crumple zones
Simple Harmonic Motion: Using a spring with a Force and Motion Sensor
Simple Harmonic Motion: Using elastic with two Force Sensors, a Motion Sensor a cart oscillating horizontally
Interference of light investigations (Young's slit)

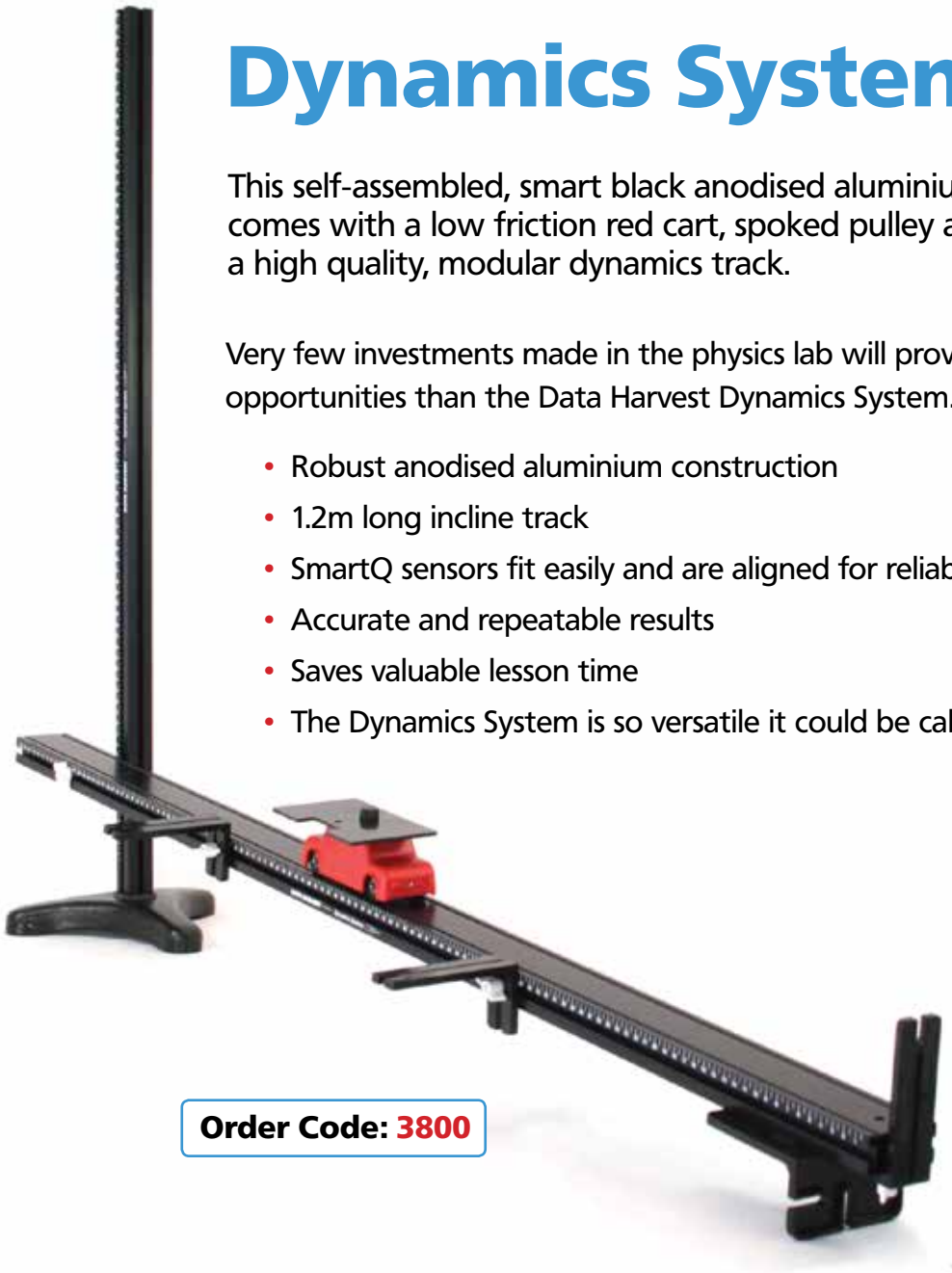
Free Material Downloads

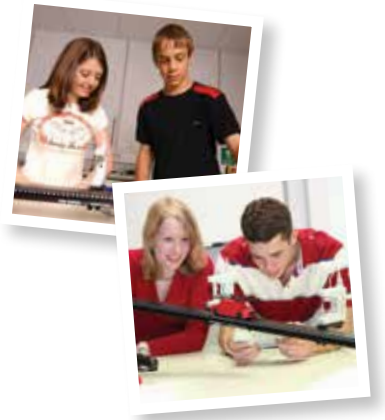
Dynamics System

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.

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





Order Code: 3800

Dynamics Cart with attachments

Spring attached for Elastic collisions

Rubber and solid bumpers

Single and double interrupt card

Magnets for both elastic and inelastic collisions

Masses attached for Newton's 2nd Law

Reflector for Motion Sensor

Optional Extension Kit

Extends the range of investigations:

Motion:

- Use the spring to roll a cart up a slope

Pendulum:

- Light Gate and simple pendulum

Collisions:

- Elastic and inelastic
- Light Gates, Motion & Force sensors
- Use Force Sensor and a Light Gate to investigate crumple zones

Simple Harmonic Motion:

- 2 Force and a Motion sensor with a cart oscillating horizontally

Extension Pack 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.

Order Code: 3801

Physics | Curriculum Solutions

Capacitor Investigation Pack

Order Code: 100100

The apparatus provides a self contained unit to enable students to study the charge and discharge characteristics of a capacitor.

- Lascells Capacitor investigation
- ±12 V SmartQ Voltage sensor
- ±100 mA SmartQ Current sensor

Faraday's Law Pack

Order Code: 100101

The apparatus lets you study the effect of coil size and the speed of a falling magnet on induced voltage.

- Faraday's Law apparatus
- ±1 V SmartQ Voltage sensor

Planck's Constant Pack

Order Code: 100102

This apparatus provides an array of 7 clear LEDs with peak emission wavelengths in the range 430 to 950 nm.

- Lascells Planck's constant apparatus
- ±12 V SmartQ Voltage sensor
- ±100 mA SmartQ Current sensor

Thermal Conduction Pack

Order Code: 100103

Study conduction of heat and calculate the coefficient of heat conduction for a variety of materials.

- Lascells Thermal conduction apparatus
- 3 x Fast Temperature sensors

Resistance Selector

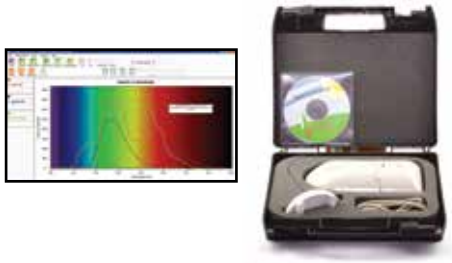
Order Code: LAS0002

A substitution unit that uses a single rotary switch to select from 12 values of resistors

Spectrometer

See page 28

A low-cost Spectrometer ideal as a general purpose instrument with applications in Physics, Chemistry and Biology



SmartMicroScopes

See page 30

USB hand-held digital microscopes for desktops and tablets. Takes still photos, videos and time-lapse videos

Genecon | Exploring Electricity

Genecon V3

Order Code: 3904

Have fun while learning about generating electricity. Use this 3V hand-held Dynamo for a simple demonstration of converting mechanical energy into electrical energy.

Turning the handle generates electricity. This instrument is perfectly suited to experiments that explain the mechanism of power generation in an easy and fun way.

The clear body allows the mechanism to be seen while in use.

Order Code: 3904

Genecon Packs

Genecon Thermo-Power Pack

Order Code: 900100PK1

Wind the handle to generate electricity and change the temperature display. Feel how much energy is needed to make heat; an ideal way to link the production of heat to energy use.

Genecon Lamp Load Pack

Order Code: 900101PK1

Four low voltage lamps connected in parallel. Use a Genecon hand generator to power the unit and feel the increase in power and energy needed to keep the lights on.

Genecon Super-C Capacitor Pack

Order Code: 900102PK1

The Super-C is a modern high capacity 10 F capacitor mounted on a board with circuit protection and charge indication. Use the Genecon to demonstrate the link between electrical generation and storage.

Lamp & LED Set

Order Code: NRK001

Connected directly to the Genecon; feel the difference in energy required to light the LED as compared to a traditional Bulb.


File Edit Docker Software Analysis Tools Help
93.7
56.8
1024.3
52.9
SmartQ

Biology | Curriculum Packs

Biology (11-18)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

1 x Biology L2 eBook
1 x Biology L3 eBook
1 x Heart Rate and Pulse Waveform
2 x Push Button Reaction Switch
1 x Temperature Sensor - Fast response
2 x Temperature Sensor
1 x Timing Mats (Pair)
1 x Colorimeter
1 x Humidity

Order Code: CSP001

Biology L2 eBook

1T Pulse
02T Armchair gymnastics
03 Not only exercise excites the heart
04 Food as fuel
05 Breathing patterns
06 Rate of consumption of O_2 to measure of respiratory activity
07 Rate of production of CO_2 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 eBook

01 Pulse
02 Armchair gymnastics
03 Not only exercise excites the heart
04 Food as fuel
05 Citrus power
06 Rate of consumption of O_2 as measure of respiratory activity
07 Rate of production of CO_2 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


100 ml

Chemistry | Curriculum Packs

Chemistry (11-18)

A curriculum pack that includes sensors and an eBook of curriculum materials.

Pack Includes:

1 x Chemistry L2 eBook
1 x Chemistry L3 eBook
1 x Gas Pressure - Differential 200kPa
1 x Colorimeter
1 x pH Pack
2 x Temperature Sensor

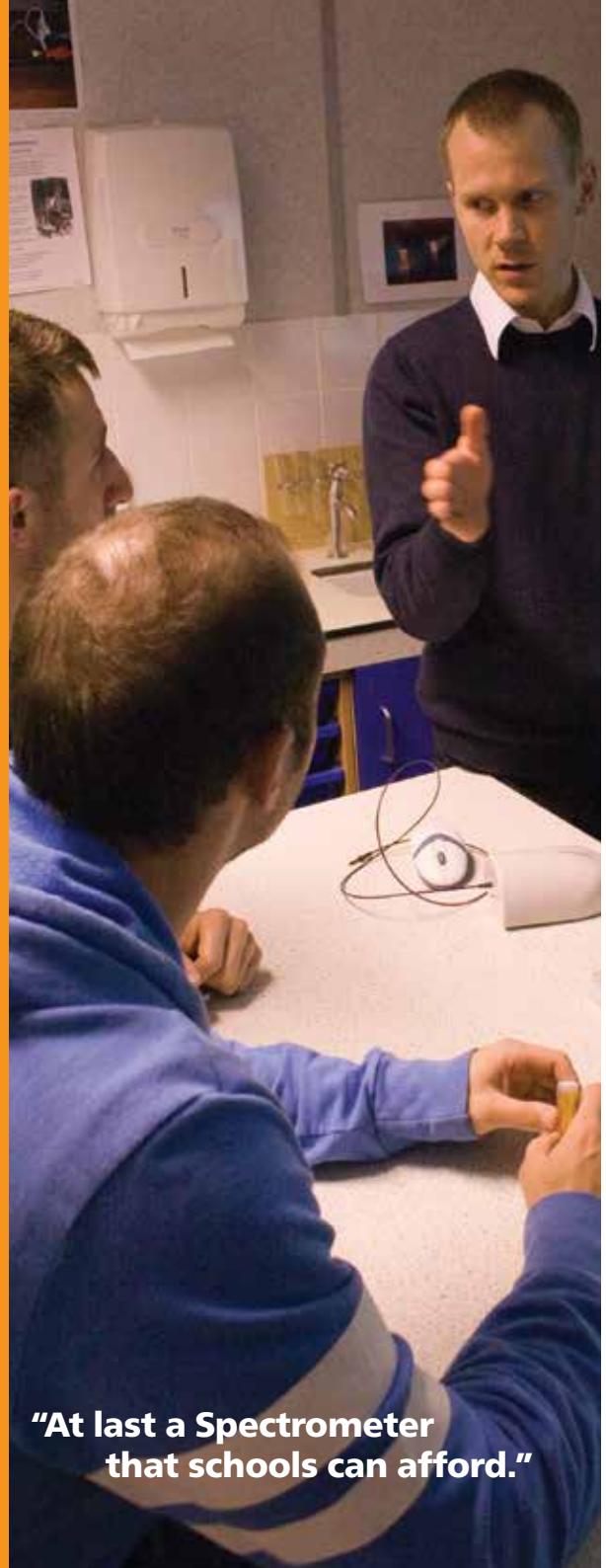
Order Code: CSP002

Chemistry L2 eBook

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 eBook

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



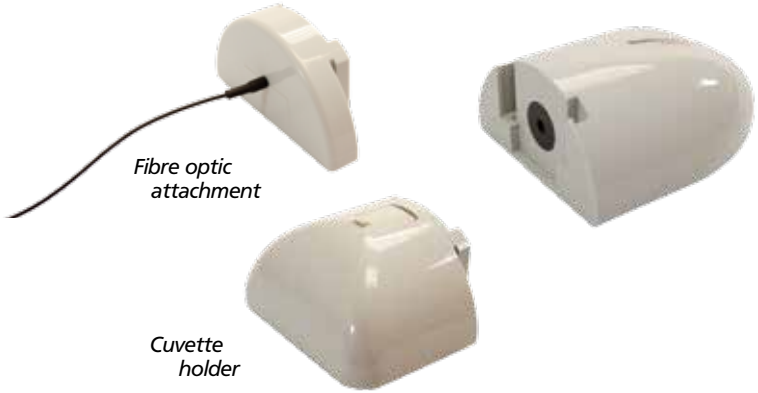
Spectrometer

An affordable, small footprint laboratory Spectrometer that has many applications in Physics, Chemistry and Biology.

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

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

Easily swap cuvette holder and optical fibre attachment.



A complete solution

Comprising 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.

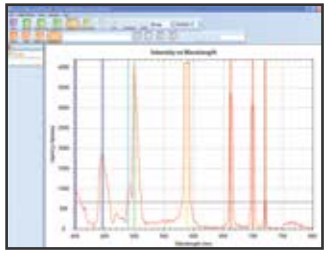
- Modular system
- Powered from USB
- 1.2m fibre optic cable
- Cuvette holder incorporating high intensity white LED
- Calibrated range 400nm to 750nm
- Resolution 1.5nm
- Accuracy ±3nm
- Integration Time 9ms to 3s
- 12bit Dynamic Range

Windows

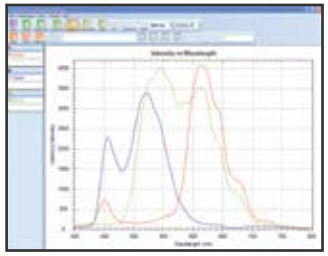
Order Code: 3310

Software | Clear, straightforward and comprehensive

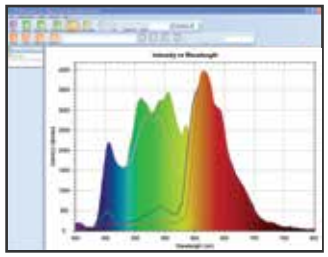
Download the free software site licence from data-harvest.co.uk



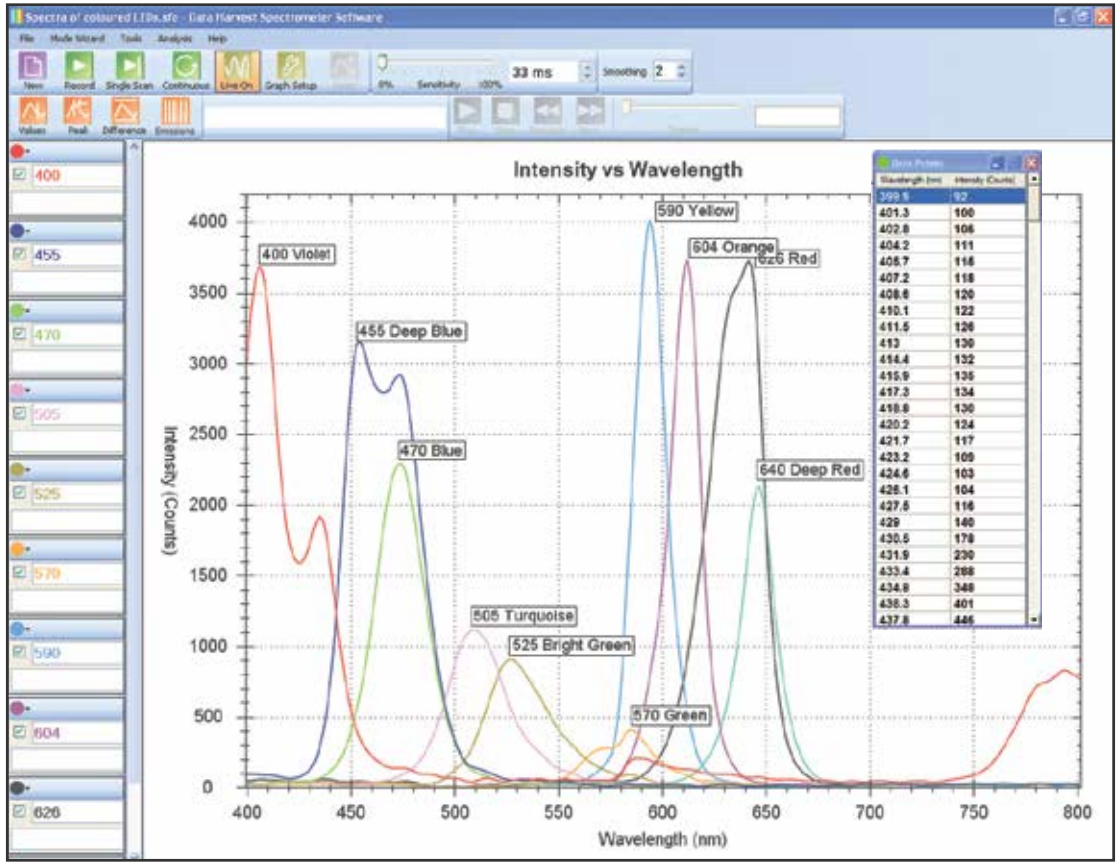
Hydrogen Emmision Lines



Spectra Line Graph



Spectr Area Graph



Emmesion spectra of LED's

Applications Include:

Biology

- Enzymes and Enzyme Kinetics
- Chlorophyll, Photosynthetic Pigments
- Photosynthesis
- Narrow wavelength colorimetry

Chemistry

- Rates of reaction - Record the change in the spectrum over time
- Demonstration of spectral analysis
- Narrow wavelength colorimetry

Physics

- Planck's constant
- Emission Lines/Spectra
- Analysing the visual spectrum

Also...

- Beer Lambert's Law
- Food Science - Quality of oils
- Sport Science - Drug Misuse
- Forensic Science - Colour Match

CSI - Crime Scene Investigation

Identify the car from a paint sample.

Colour Samples

Demonstrate the principles of Forensic Spectrometry with these carefully selected colour samples.
Use the reds to simulate blood, the greens as oil, or use the whole series to show principles of Spectrometry.

Order Code: 3320

Windows

Free download from: data-harvest.co.uk

SmartMicroScopes | PC, Mac, iPad & Android

Designed for education, easy to use and perfect for all ages

- Identify parts of plants and animals
- Observe life cycle changes
- Compare different types of rock
- Examine pond water
- View prepared slides
- Examine clothing and textiles
- Explore Owl pellets
- Investigate sand and soil contents

- Take Pictures
- Record Video
- Measure
- Compare

5M (5 Megapixel)

Order Code: SMSS225

10x - 200x magnification

USB PC & Mac

Includes:

- Scope
- Stand
- Software site licence

5M 500x (5 Megapixel)

Order Code: SMSS227

500x magnification

USB PC & Mac

Includes:

- Scope
- Stand
- Software site licence

iGo

Order Code: SMSS325

Wi-Fi to iPad & Android

Includes:

- Scope
- Rechargeable batteries
- Battery charger
- Free app download

Metal Stand

Order Code: SMSS341

For 5M, 5M 500x & iGo

Gooseneck Stand

Order Code: SMSS319

For 5M & 5M 500x

Backlit Stand

Order Code: SMSS342

LED lit. X, Y and Z controls

Lens Tip Set

Order Code: SMSS321

4 Tips: 15x 30x 50x & 150x

Cradle

Order Code: SMSS323

3 Tips: 15x 23x & 40x

SmartMicroScope Packs

Includes microscopes, accessories and curriculum materials.

For PC & Mac

Order Code: SMS0001

Windows OS X

- Biology Investigation Book
- Middle School Investigation Book
- SmartMicroScope 5M
- SmartMicroScope 5M 500x
- Lens Tip Set
- Gooseneck Stand
- Backlit Stand

For iPad & Android

Order Code: SMS0002

iOS Android

- Biology Investigation Book
- Middle School Investigation Book
- SmartMicroScope iGo
- Metal Stand
- Backlit Stand
- Cradle

48 Slide Set

Order Code: SMSS431

Animals, Plants, Insects, Amphibians/Frogs

Specimen Set 1

Order Code: SMSS418

Cricket, Locust, Beetle & Crab in acrylic block

Specimen Set 2

Order Code: SMSS419

Scorpion, Ant, Wasp & Flower Bug in acrylic block

Rock Set

Order Code: TIM0001

A complete rock set containing 48 samples:

- Metamorphic
- Sedimentary
- Igneous
- Mineral

SENSORS

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

General Sensor Pack

Chemistry (11-18)

A starter pack for the whole science department

Pack Includes:

3 x Temperature Sensor
1 x Light Level
1 x pH Pack
2 x Light Gates
1 x Voltage - Differential 20V

Order Code: GSP2

ACCELEROMETER

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 40g.

The lower range sensor can record 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 ms-2.

Ideal Companion: Dynamics System see page 21

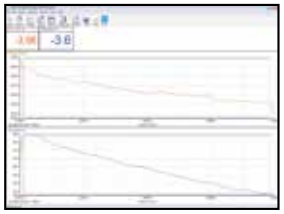
Low g Accelerometer
Order Code: 3200
RANGES:
- **±2.5g** *3 axis (xyz)*
- **±10g** *3 axis (xyz)*
- **±25ms^{-2}** *3 axis (xyz)*
- **±100ms^{-2}** *3 axis (xyz)*

High g Accelerometer
Order Code: 3201
RANGES:
- **±40g** *2 axis (xy)*
- **±400ms^{-2}** *2 axis (xy)*

BALANCE ADAPTOR FOR THE OHAUS® RANGE

This adaptor, when connected to an Ohaus Top-Pan Balance, simultaneously 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
Order Code: 3060
Scout Pro models:
- **SPU202, 401, 402, 601, 602, 2001, 4001, 6000, 6001**

Balance Adaptor
Order Code: 3065
Traveler models:
- **TA152, 303, 301, 501, 1501, 3001, 5000**

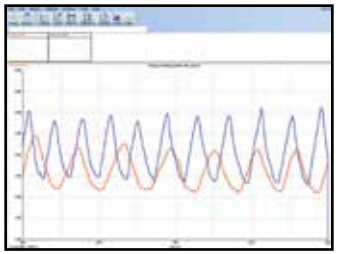
BREATHING RATE BELT PACK

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 Code: 3190
Gas Pressure Differential
Order Code: 3139
RANGE:
±10kPa

CARBON DIOXIDE

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 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.

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)

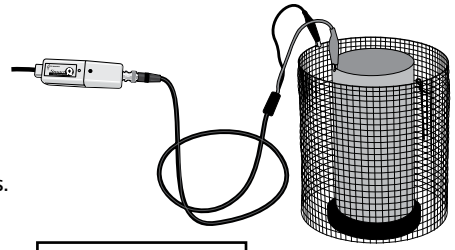
Order Code: 3152
RANGES:
- **0 to 10,000ppm**
- **0 to 100,000ppm**

CHARGE

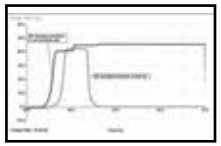
Used to measure the amount of charge on a source when the charge available is very small.

As in many electrostatic experiments. It can replace a traditional gold leaf electroscope by showing not only the polarity of the charge but also performing quantitive measurements.

It can also measure the potential difference between two points.



Faraday's ice pail



Applications Include:

- Magnitude and sign of the charge on different objects
- Electrostatic phenomena
- Simple demonstrations of sign of charge
- Charge sharing between conductors
- Faraday's ice pail investigations
- Electrostatic shielding
- Induced charge
- Charging by induction
- Investigating the relationship 'Voltage is proportional to the charge on an object' by adding charges

Order Code: 3268
CHARGE RANGES:
- **±10 nCoulomb (nC)**
- **±100 nCoulomb (nC)**
- **±220 nCoulomb (nC)**

VOLTAGE RANGES:
- **±0.5 V (500 mV)**
- **±2 V**
- **±10 V**

COLORIMETER

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.

Applications Include:

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

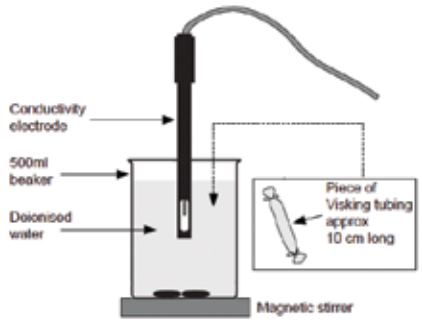
Order Code: 3275
RANGES:
- **0 to 110% Transmittance**
- **0.0500 to 1.0500 Absorbance**

CONDUCTIVITY PACK

This pack contains both the electrode and the SmartQ Adaptor.

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.



Does the concentration of a solution affect movement across a membrane?

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

Order Code: *3135PK*
RANGES:
- **0 to 100µS**
- **0 to 1mS**
- **0 to 10mS**
- **0 to 100mS**

Includes:

Conductivity Adaptor
Order Code: 3135
Conductivity Electrode
Order Code: 3136

CROCODILE CLIPS (PAIR)

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.

Typical Investigations:

- Timing an event with the crocodile clips attached to a 'pupil' designed switch e.g. a pressure mat sensitive enough to detect a small animal
- A Reaction time investigation – using home-made reaction switch with a simple circuit and lamp
- Gravity investigations – record the time from A to B as an object falls using a home-made digital 'target area' as input B

Order Code: 3260

CURRENT - DIFFERENTIAL INPUT

There are 3 Current sensors with different ranges that measure both AC and DC.

With differential inputs these sensors can be used anywhere within a circuit and in conjunction with a Voltage sensor.

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

Order Code: 3166
RANGE: ±100mA

Order Code: 3165
RANGE: ±1A

Order Code: 3167
RANGE: ±10A

DROP AND BUBBLE COUNTER

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

Order Code: 3266
RANGES:

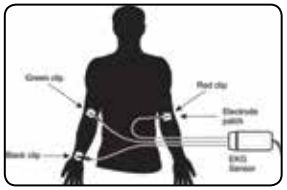
- **0 to 10,000 count**
- **0 to 120 cm^3 volume at a drop rate from 23 to 29 drops per cm^3**

E.C.G. (ELECTROCARDIOGRAM)

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.

Tip: Fast data sampling (≥50Hz) and 12 bit logger resolution is required to capture the details of the PQRS complex.

Supplied with a pack of 100 disposable ECG electrode patches.



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)

Order Code: 3279
RANGE:

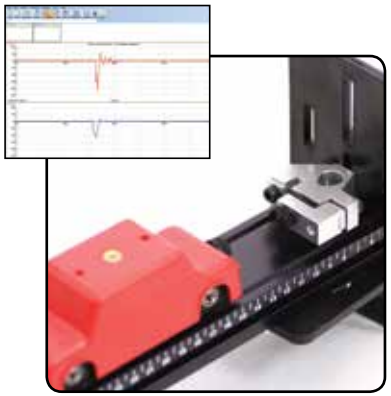
- **200 to 4,000μV**

FORCE SENSOR

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.

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)

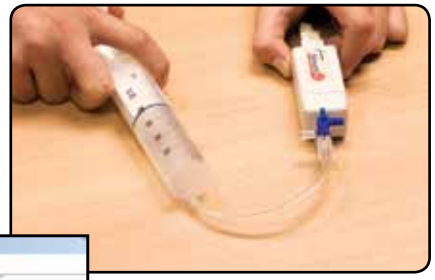
Order Code: 3143
RANGE:

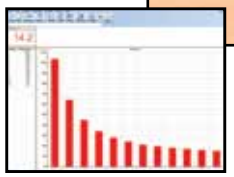
- **±50N**

GAS PRESSURE - ABSOLUTE

These two sensors measure 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. The 3210 sensor 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 pulled back.

Applications Include:

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

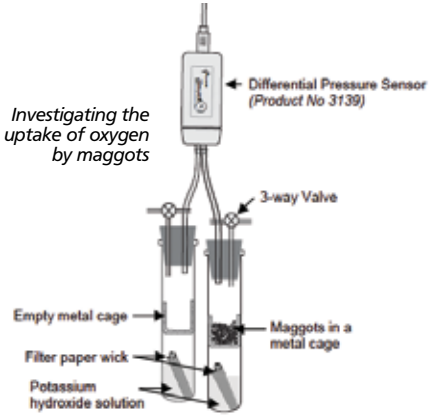
Order Code: 3210
RANGES:
- **0 to 110kPa Absolute**
- **0 to 33in Hg**
- **Altitude -500m to 12,000m**

Order Code: 3142
RANGES:
- **0 to 700kPa Absolute**
- **0 to 100psi**

GAS PRESSURE - DIFFERENTIAL

These sensors measure the differential pressure between two ports. If one is left open, measurement will be relative to atmospheric pressure.

Blowing into one port will produce a positive value, whereas blowing into the other port will produce a negative value.



Investigating the uptake of oxygen by maggots

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:

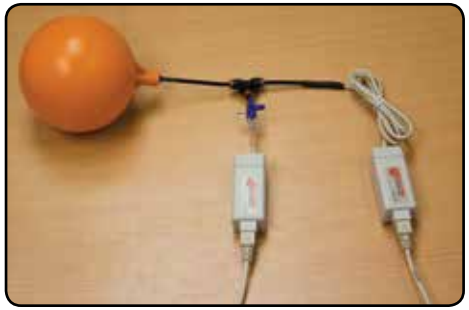
- Temperature/volume relationships
- Boyle's Law (pressure vs. volume)
- Rates of reaction where a gas is evolved

Order Code: 3139
RANGES:
- **±10kPa**
- **±1.5psi**

Order Code: 3141
RANGES:
- **±200kPa**
- **±30psi**

GAS PRESSURE ACCESSORY PACK

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 ball cock, Pressure and Temperature sensor to investigate Charles Law.

This pack contains:

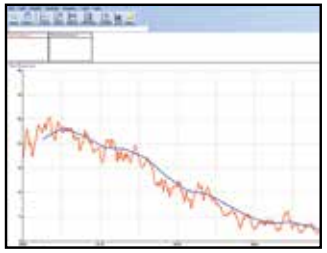
- 1x 1m PVC tube - 3mm bore x 1mm wall thickness
- 1x 1m of nylon pneumatic tube 4mm O.D x 2.5mm I.D
- 4x Large pipette tips
- 4x Small pipette tips
- 1x Straight push fit connector
- 1x Tee piece push fit connector
- 2x 3-way stop cocks
- 1x 20ml Syringe

Order Code: 3138

GEIGER MULLER

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 Data Logger.



Radioactive decay of Protactinium

Applications Include:

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

Order Code: 3265
RANGES:
- **Counts per second**
- **Counts per 10 seconds**
- **Counts per minute**
- **Open count**
- **Pulse Output (0-100%)**

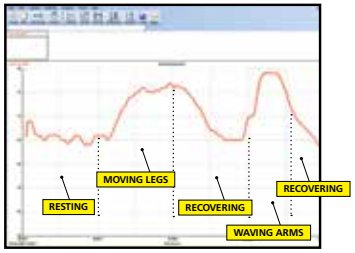
HEART RATE & PULSE WAVEFORM

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.

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



Heart Beats: Changes due to mild activity.

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!

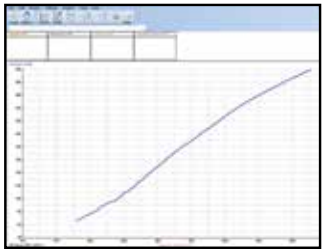
Order Code: 3147
RANGES:
- **0-200 Beats per minute**
- **±2000mV Waveform**

HEAT FLOW

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.



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.

Applications Include:

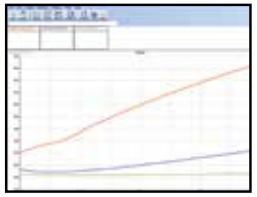
- Investigating insulation properties
- Newton's Law of cooling
- Heat flow to cold objects
- Heat flow from hot objects
- Heat loss from the body e.g. through clothes; from different parts of the body, etc.
- Heat flow or loss in buildings e.g. through single and double-glazed windows; from different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

Order Code: 3150
RANGE:
- **±2kWm^{-2}**

HUMIDITY

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.



Applications Include:

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

Order Code: 3145
RANGE:
- **0 to 100%RH**

INFRARED

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.

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

Residual heat - thermal imaging.

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

Order Code: 3278
RANGES:
Radiance
- **0 to 30W/m^{2}sr^{-1}**
- **0 to 300W/m^{2}sr^{-1}**
- **0 to 3000W/m^{2}sr^{-1}**

Irradiance
- **0 to 20W/m^2**
- **0 to 200W/m^2**
- **0 to 2000W/m^2**

INTERRUPT CARD SET

The Interrupt card set consists of 3 cards used with Light Gates.

- 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.

Applications Include:

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

Order Code: 3803

LASER MODULE

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 during optic experiments.

Laser mounted on the Dynamics System investigating diffraction patterns.

Applications Include:

- Young's Slit
- Optics

Order Code: 3285

LIGHT GATE

The SmartQ Light Gate is a digital switch-type sensor that has two states, ON and OFF.

The Light Gate has an infrared 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 and the Interrupt Card Set.

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

Order Code: 3250

LIGHT LEVEL

This 5 range sensor cleverly measures light levels from 0 through to 100,000 Lux.

Four 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 fast response 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:

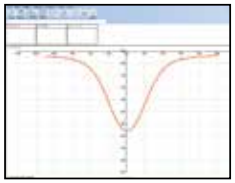
- Inverse Square Law
- Environmental monitoring
- Colorimeter experiments
- Yeast growth
- Absorption of light
- AC modulation

Order Code: 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 - 110% Transmission**

MAGNETIC FIELD

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.



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

Applications Include:

Physics:
- Magnetic field in a wire coil
- Magnetic field in a Slinky Spring
- Magnetic field of magnets
- Magnetic field of a solenoid

General:
- Mapping a magnetic field
- Exploring electromagnets

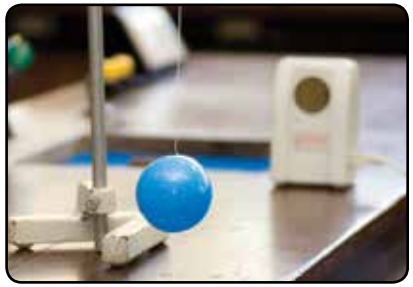
Order Code: 3170
RANGE:
- **±10mT radial and axial**

Order Code: 3172
RANGE:
- **±100mT radial and axial**

MOTION

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.



Applications Include:

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

Order Code: 3270
RANGES:
Distance
- **0.15 to 3m**
- **0.15 to 1m**
- **0.15 to 2m**
- **0.15 to 4m**
- **0.15 to 8m**
- **15 to 800cm**
- **6 to 300 inches**

Time
- **1000 to 50000µS**

OXYGEN PACK

This pack contains both the oxygen adaptor and the electrode.

The dual range sensor measures oxygen in air (for short durations) and also dissolved oxygen levels in water.

It has built-in automatic temperature compensation.

Complete Pack

Applications Include:

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

Order Code: 3130PK
RANGES:
- **0 to 25% 0_2 in Air**
- **0 to 125% DO_2 Sat**

Includes:

Oxygen Adaptor
Order Code: 3130

Oxygen Electrode
Order Code: 3131
Includes 2 spare membranes & electrolyte

pH PACK

The pH adaptor and general pH electrode 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 is a general purpose plastic bodied glass non-refillable electrode, suitable for most investigations.

Complete Pack

Applications Include:

Chemistry:
- Testing acids and alkalis
- Acid-Base titrations
- Acid rain

Biology:
- Enzyme action
- Respiration

Environment:
- Water quality

Order Code: 3125PK
RANGE:
- **0 to 14pH**

includes:

pH Adaptor
Order Code: 3125
pH Electrode
Order Code: 2251

POLAR HEART RATE EXERCISE SENSOR

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.

Applications Include:

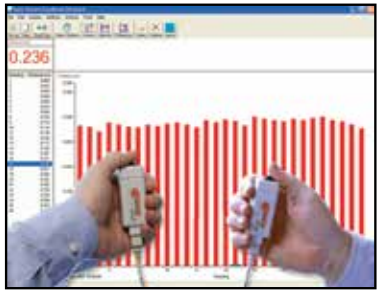
- Monitor heart rate before, during and after vigorous activity
- Monitor the speed at which the heart rate returns to normal following exercise (recovery rate)
- Investigate the effects of a mild stimulant such as caffeine in cola or coffee on heart rate
- Check for baroreceptor reflex: that is changes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

Order Code: 3148
RANGE:
- **0 to 220 beats per minute**

PUSH BUTTON REACTION SWITCH

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

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



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

Order Code: 3261

RF ELECTROSMOG

The SmartQ RF Electrosmog 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 Electrosmog 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.

Measuring RF from a mobile phone.

Investigating the RF from a communications mast.

Applications Include:

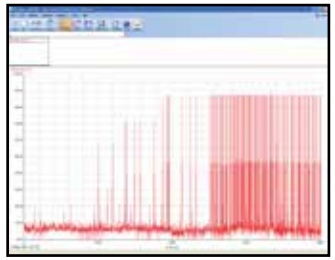
- Mobile phones
- Microwave smog
- RF Interference

What Is Electrosmog?

Electrosmog is a term applied to the background, invisible, electromagnetic radiation resulting from the use of both wireless technology and mains electricity.

The most common sources of RF Electrosmog are:

- Cordless phones (DECT mobile landline)
- Cordless baby alarms
- Mobile/cellular phone masts/towers/ transmitters
- Mobile/cellular phones
- Wireless networks – Wi-Fi
- TV senders
- Remote controls for Cars, alarm systems



Order Code: 3159

RANGES:

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

Ideal Companion:

- **Key Fob - RF Transmitter**
  Order Code: 3158

ROTARY MOTION SENSOR

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.

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

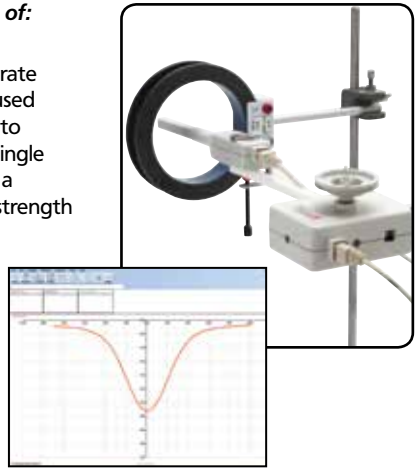
Order Code: 3280

RANGES:
- **11mm Pulley: ±200mm distance**
- **31mm Pulley: ±2000mm distance**
- **49mm Pulley: ±2000mm distance**
- **Angular Position: 0 to 360°**
- **Angular Velocity: ±40rads per second**
- **Angular Velocity: ±4 revs per second**
- **Pendulum: ±20°**
- **Linear Rack: ±200mm**

ROTARY MOTION ACCESSORY KIT

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

The study of pendulum motion



Magnetic field within a coil is plotted against position.

Applications Include:

Physics:
- Pendulum studies
- Conservation of angular momentum
- Rotational inertia – using the discs
- Circular movement – using the discs
- Linear motion – using the linear rack and Light sensor e.g. inverse square law

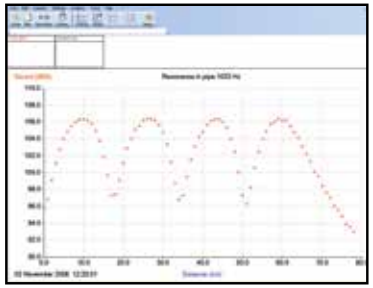
Chemistry and Biology:
- Linear movement e.g. gas syringe plunger movement

Order Code: 3288

SOUND LEVEL

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

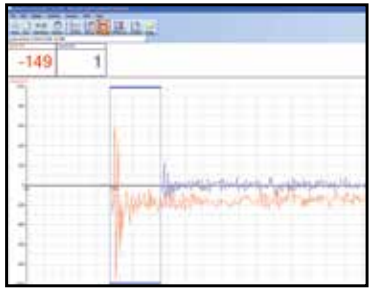
Order Code: 3175
RANGES:
- **40 to 110dBA**
- **Waveform ±2000mV**

SPEED OF SOUND PACK

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.



Tip: This sensor pack requires a Data Logger capable of fast recording.

Applications Include:

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

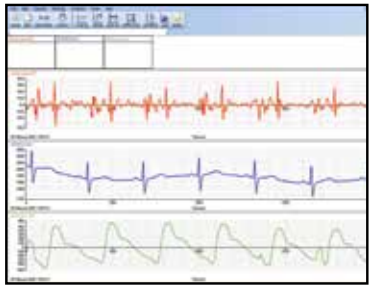
Order Code: 3179

STETHOSCOPE PACK

The pack contains a SmartQ Stethoscope sensor and a conventional binaural stethoscope (to help students to locate their heart manually).

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 Rate sensor a full physiology of the heart cycle can be recorded and analysed.



Applications Include:

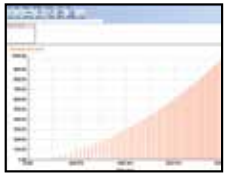
- Sound level changes in a heart beat

Order Code: 3176PK
RANGES:
- **Stethoscope ±100mV**
- **Stethoscope F* ±100mV**
- **Sound ±1000mV**
- **Sound F* ±1000mV**

includes a low pass filter to remove high frequency noise

SPOKED PULLEY

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.



Motion down an inclined plane.

Applications Include:

- Motion detection
- Atwoods engine

Order Code: 3177

SPIROMETER

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 PC 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 subject's use only and should be regarded as a 'disposable' item.

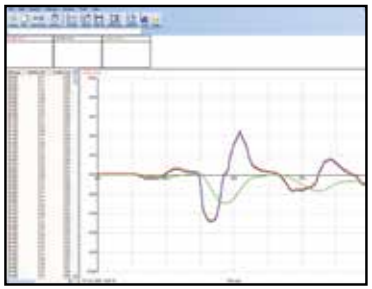
Replacement parts are available: Pack of 10 replacement flow head filters (3269) and pack of 5 nose clips (3264).

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

Applications Include:

- Lung capacity
- Fitness profiling
- Flow volume loop

Lung capacity.



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

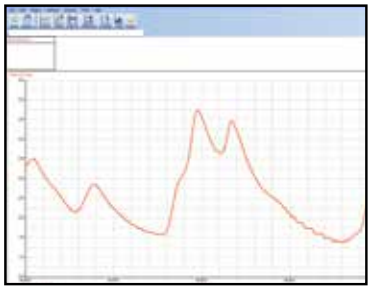
Order Code: 3267
RANGE:
- **±10.0 litres/second**

COUNT/TACHOMETER ADAPTOR

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 used to connect any switch e.g. a magnet and reed switch or a foot switch.

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



Typical graph monitoring wind speed.

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

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

Order Code: 3296
RANGES:
- Cumulative counts 0 - 1000
- Cumulative counts 0 - 60000
- Counts per second
- Revs per minute
- Revs per second

Accessory Ranges:
- Anemometer (m/s)
- Anemometer (mph)
- Rain gauge - 1mm per tip
- Spoked pulley (m/s)
- Spoked pulley (mph)
- Spoked pulley (m)

ANEMOMETER

The Anemometer is constructed using a high quality ball bearing, stainless steel hardware, UV stable plastic, and durable anodized aluminium hemispherical cups that are weight matched.

Tip: Requires count/tachometer

RAIN GAUGE

A `tipping bucket' type rain gauge. As rain falls the water runs down through the collecting funnel into a self-emptying spoon which tips and empties each time the equivalent of 1 mm of rain has fallen. Total rainfall is measured by counting how many times the bucket tips.

Tip: Requires count/tachometer

Anemometer
Order Code: 3297

Anemometer Gauge with Count/Tachomenter adaptor
Order Code: 3297PK

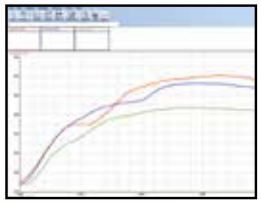
Rain Gauge
Order Code: 3298

Rain Gauge with Count/ Tachomenter adaptor
Order Code: 3298PK

TEMPERATURE - GENERAL PURPOSE

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 a stainless steel tube, it is resistant to dilute acids.



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

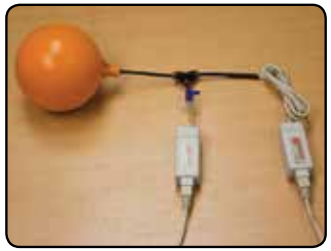
Applications Include:

- 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
- Pond and river studies

Order Code: 3100
RANGES:
- **-30°C to +110°C**
- **-22°F to 230°F**

TEMPERATURE - FAST RESPONSE

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

Applications Include:

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

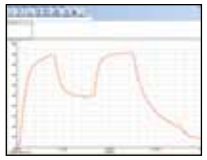
Chemistry:
- Universal gas laws

Order Code: 3101
RANGES:
- **-30°C to +110°C**
- **-22°F to 230°F**

TEMPERATURE - HIGH RANGE

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

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').



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?

Order Code: 3105
RANGE:
- **-200°C to +1,000°C**

TIMING MATS (PAIR)

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.

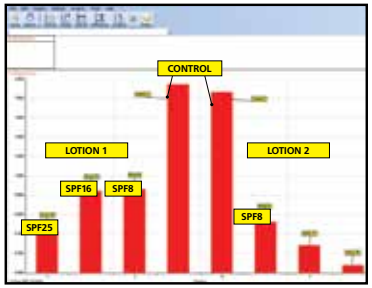
Applications Include:

- 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?

Order Code: 3255
- **2 Timing Mats** ***(58cm x 17cm in size)***

ULTRA-VIOLET

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

Order Code: 3277
RANGES:

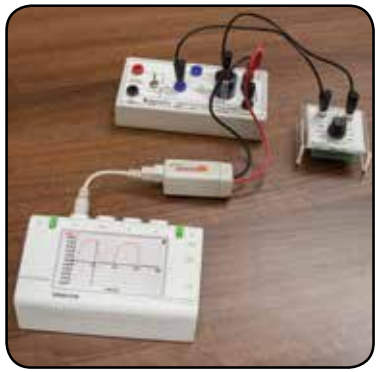
Slow Response:
- **0 to 50W/m²**
- **0 to 5W/m²**
- **0 to 500mW/m²**

Fast response:
- **0 to 50W/m²**
- **0 to 5W/m²**
- **0 to 500mW/m²**

VOLTAGE - DIFFERENTIAL INPUT

There a 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.



Applications Include:

Physics:
- Series and parallel circuits
- Current and voltage relationships
- Resistance
- Electrical characteristics
- Induced emf (3162 0nly)
- Battery comparisons
- Capacitor charge/discharge
- Ohm's law

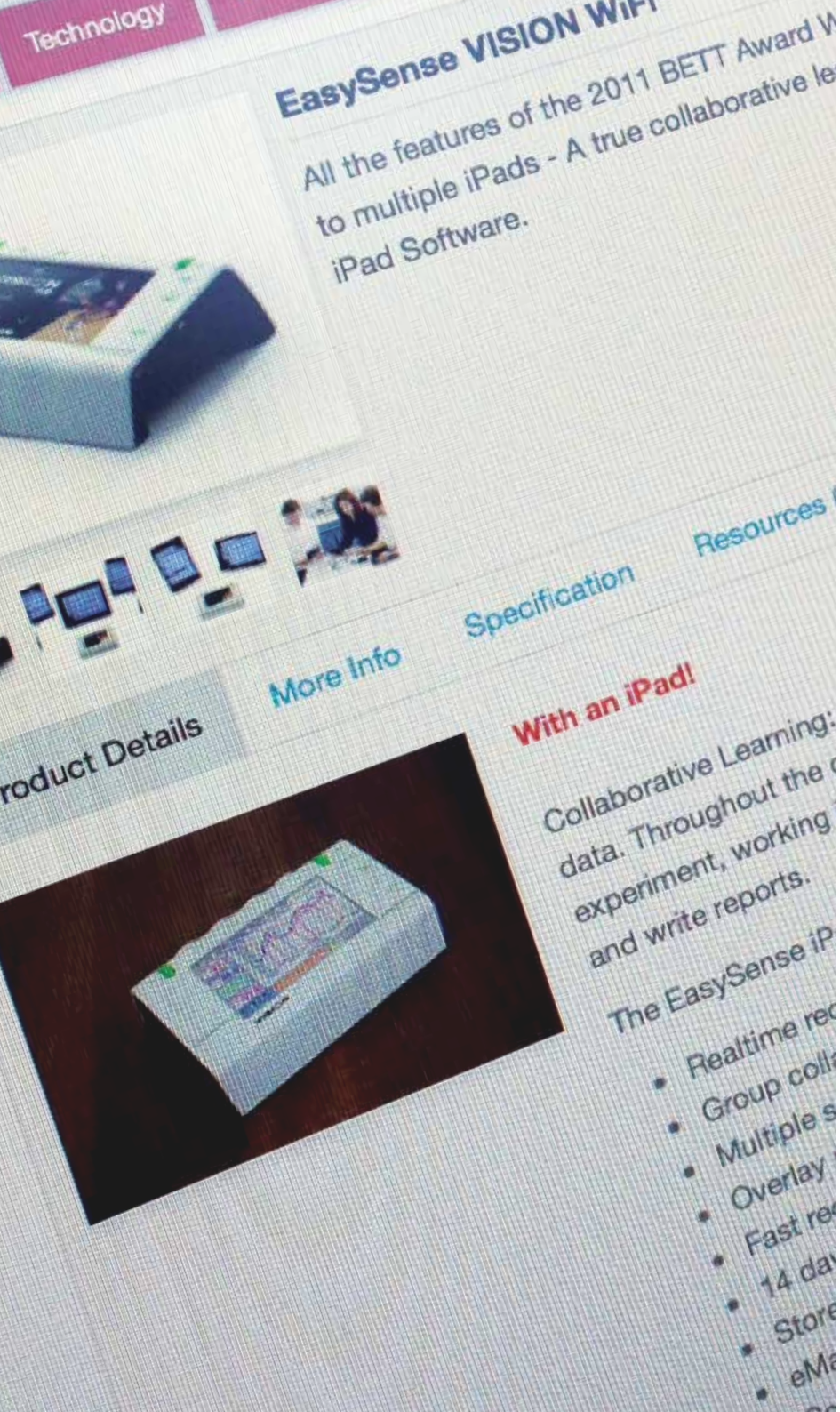
Environmental:
- Alternative sources of energy

Order Code: 3160
RANGE: ±20V

Order Code: 3160-12
RANGE: ±12V

Order Code: 3161
RANGE: 0 to 10V

Order Code: 3162
RANGE: ±1V



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Argentina, 2 - Nave A6 - Pol. Ind. Casarrubios
28806 - ALCALÁ DE HENARES - MADRID
Tel.: 918 023 562 - Fax: 918 781 690
ventus@ventusciencia.com - www.ventusciencia.com

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