

A complete range of sensors for real world interaction

These sensors are for educational use only and should not be used in life critical systems.

Who should use these sensors?

This document details external sensors that can be used with both the Flowlog and the PICmicro development board.

Flowlog is a flexible unit that provides datalogging, control and electrical measurement functions for use in a variety of educational situations – notably in the study of science and electronics.



Matrix Flowlog - Lite version

The **version 2 PICmicro development board** is designed to allow students aged 14 upwards to develop microchips based on the PICmicro series of devices. All sensors can be used in conjunction with the 3 CD ROMs (Flowcode, C for PICmicros and Assembly for PICmicros).



Version 2 development board

Details of both products are available on our web site.

Note for PICmicro development board users

Commonly used sensors for the version 2 PICmicro development board users

We recommend that customers who want to introduce their students to sensors purchase a core set that will introduce students to different techniques and strategies of gathering real world data in both analogue and digital form. In brief these are:

Sensor	Output/action	Coding strategy
Temperature probe	Simple potential divider	A/D conversion, calibration, value look up, display
Motion detector	Gives out a digital pulse correlating to distance	Active sensor, pulse time measurement, conversion and display
Heart rate monitor	Gives out an analogue voltage pulse	Data slicing, and timing
Photogate and pulley wheel	When IR light path is interrupted, digital output changes	Various

Please note that all other sensors are available for PICmicro development board users.

<p>Barometer</p>  <p>Description Our Barometer can be used for either weather studies or for lab experiments involving pressures close to normal atmospheric pressure. The pressure range is 24 to 32 inches of Hg (0.8 to 1.05 atm) absolute pressure.</p> <p>Specification Analogue sensor Range: 24 to 32 in Hg (0.80 - 1.05atm)</p> <p>Code:HSBAR</p>	<p>Colourimeter</p>  <p>Description This is a 3-wavelength (red-635 nm, green-565 nm, blue-470 nm) Colourimeter. It is great for Beer's law experiments, determining the concentration of unknown solutions, or studying changes in concentration vs. time. Fifteen 3.5-mL cuvettes are included.</p> <p>Specification Analogue sensor For best results, our laboratory testing of the colorimeter indicates that absorbance or transmittance values should fall within these ranges: percent transmittance: 28% - 90% absorbance: 0.050 - 0.550 Resolution: 0.16 % T</p> <p>Code:HSCOL</p>	<p>Conductivity probe</p>  <p>Description This probe is great for environmental testing for salinity, total dissolved solids (TDS), or conductivity in water samples. Biology teachers can use this probe to demonstrate diffusion of ions through membranes or to monitor changes in ion levels in aquatic systems. Chemistry students can use it to investigate the difference between ionic and molecular compounds, strong and weak acids, or ionic compounds that yield different ratios of ions.</p> <p>Specification Analogue sensor 0-100 mg/L TDS or 0-200 μS/cm 0-1000 mg/L TDS or 0-2000 μS/cm 0-10000 mg/L TDS or 0-20,000 μS/cm</p> <p>Code:HSCON</p>
<p>Current probe</p>  <p>Description Use the Current Probe to measure currents in low-voltage AC and DC circuits. With a range of ± 0.6 A, this system is ideal for use in most "battery and bulb" circuits. Use it with the Differential Voltage Probe to explore Ohm's law, phase relationships in reactive components, and much more. Use multiple sensors to explore series and parallel circuits. It can also be used in electrochemistry experiments.</p> <p>Specification Analogue sensor ± 0.6 A Resolution: 0.6mA</p> <p>Code:HSDCP</p>	<p>Differential voltage probe</p>  <p>Description Use the Differential Voltage Probe to measure low-voltage AC and DC circuits. With a range of ± 6.0 V, this system is ideal for use in most "battery and bulb" circuits. Use it with the Current Probe to explore Ohm's law, phase relationships in reactive components, and much more. This differs from the Voltage Probe that comes with your interface in that neither clip is connected to ground. Use multiple sensors to explore series and parallel circuits</p> <p>Specification Analogue sensor</p> <p>Code:HSDVP</p>	<p>Dissolved Oxygen probe</p>  <p>Description You can make fast, accurate measurements of dissolved oxygen concentration in water samples using our Dissolved Oxygen Probe. This probe has a range of 0 to 14 mg/L (ppm) of dissolved oxygen. It has built-in temperature compensation, which means you can do your calibrations in the lab, and then make measurements outdoors without having to recalibrate. The probe has a fast response time, reaching 95% of full reading in 30 seconds. This probe is great for biology, chemistry, ecology, or integrated science courses.</p> <p>Specification Analogue sensor Range: 0 to 14 mg/L (or ppm) Resolution: 0.028 mg/L Temperature Compensation: automatic from 5-35°C</p> <p>Code:HSDO</p>
<p>Dual range force sensor</p>  <p>Description The Dual-Range force sensor has two ranges: ± 10N or ± 50N. It can be easily mounted on a ring stand or dynamics cart (mounting bracket included), or used as a replacement for a hand-held spring scale. Use it to study friction, simple harmonic motion, impact in collisions, or centripetal force.</p> <p>Specification Analogue sensor Range: -10 to +10 N, Resolution: 0.024 N Range: -50 to +50 N, Resolution: 0.12 N</p> <p>Code:HSDFS</p>	<p>ECG sensor</p>  <p>Description The ECG Sensor measures electrical signals produced by the heart. It uses three disposable electrodes. An ECG graph is displayed, demonstrating to students the contraction and repolarization of the heart's chambers. A package of 100 disposable electrodes is included with the sensor.</p> <p>Specification Analogue sensor</p> <p>Code: HSEKG</p> <p>A pack of 100 spare electrodes (Code HSELEC) are also available.</p>	<p>Fast response Photogate</p>  <p>Description Photogates can be used to study free fall, rolling objects, air track collisions, pendulums, etc. These inexpensive, ready-to-use photogates are similar to the traditional PASCO photogate, but have no stand.</p> <p>Photogates become particularly useful when used with the smart pulley adaptor (code HSSPA) for measuring speed, the picket fence (code HSPF) which is used for measuring g or the bar tape (code HSTAPE) which replaces ticker tape.</p> <p>Specification Digital sensor</p> <p>Code: HSVPG</p> <p>Several accessories for the Photogate are also available.</p> <p>Smart pulley code: HSSPA Bar tape code: HSTAPE Picket fence code: HSPF</p>

Flow rate sensor



Description
The Flow rate sensor allows you to easily measure stream velocity for environmental or earth science studies. Using this durable sensor, students can measure the flow of a stream at different points. The impeller rod separates into four sections for easy transport and convenient storage. The Flow rate sensor comes equipped with a five-metre cable so your data collection equipment can stay on-shore while you measure flow rate in the stream. Three riser rods are included with each sensor, which enable the impeller to be placed at fixed depths.

Specification
Analogue sensor
Range: 0 to 3.5 m/s, Resolution: 0.005 m/s

Code:HSDFS

Gas pressure sensor



Description
The Gas pressure sensor has enough resolution and range to work for most subject areas. Chemistry teachers will find that it has enough range for Boyle's law experiments (0 to 2.1 atm), yet provides greatly improved resolution for vapour pressure or pressure-temperature experiments. For biology teachers, the package includes airtight tubing clamps for respiration experiments, as well as special fittings for respiration experiments in small containers. These gas-pressure accessories are included with sensor: plastic tubing with 2 Luer-lock connectors, 2-hole rubber stopper with two Luer-lock adapters, 2-way valve, 1-hole rubber stopper with one adapter.

Specification
Analogue sensor
Range: 0 to 210 kPa (0 to 2.1 atm or 0 to 1600 mmHg)
Resolution: 0.2 kPa (0.002 atm or 1.6 mmHg)

Code:HSGPS

Heart rate monitor



Description
The Exercise Heart Rate Monitor is ideal for determining the heart rate of actively moving individuals. With this sensor, a person's heart rate can be monitored during, as well as after exercise. The Exercise Heart Rate Monitor consists of a wireless transmitter belt and a receiver module. The transmitter belt senses the electrical signals generated by the heart much like an ECG. For each heartbeat detected, a signal is transmitted to the receiver module, and a heart rate can be determined.

Specification
Analogue sensor

Code:HSEHR

Instrumentation amplifier



Description
The Instrumentation Amplifier monitors voltages from a few millivolts (DC or AC). It has several switch settings to allow you to select the best gain. Typical uses would include amplifying the chart recorder output of any instrument (such as a Gas Chromatograph) so that its signal can be used with our lab interface or building a current sensor by measuring the voltage drop across a resistor.

Specification
Analogue sensor
Range Settings: 0-20 mV, 0-200 mV, 0-1 V, ± 20 mV, ± 200 mV, ± 1 V

Code:HSINA

Low g accelerometer

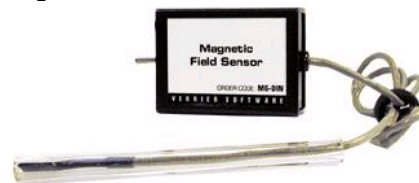


Description
This small device can be mounted on moving objects and has a flexible 2-meter cable. Use it for studying the one-dimensional motion of a car (real and toy), elevator, pendulum bob, or amusement park ride.

Specification
Analogue sensor
Range: $\pm 5g$ (± 50 m/s²)
Sensitivity: ± 0.1 m/s/s

Code:HSACC

Magnetic field sensor



Description
This sensor, which uses a Hall Effect transducer, is sensitive enough to measure the earth's magnetic field. It can also be used to study the field around permanent magnets, coils, and electrical devices.

Specification
Analogue sensor
Low sensitivity range: -6.4 mT to +6.4 mT (millitesla)
High sensitivity range: -0.32 mT to +0.32 mT

Code:HSMG

Motion detector



Description
The Motion Detector functions like the automatic range finder on a Polaroid camera. This sonar device emits ultrasonic pulses and waits for an echo. The time it takes for the reflected pulses to return is used to calculate distance, velocity, and acceleration. The range is 0.4 to 6 meters. Our Motion Detector has a pivoting head, rubber feet, and a clamp for mounting.

Specification
Digital sensor
Frequency of the ultrasound: 49.4 kHz
Resolution: 1 mm, Range: 0.40 to 6.0 meters

Code:HSMD

O₂ sensor



Description
The O₂ gas sensor measures oxygen concentration in air. The O₂ gas sensor requires no special preparation or calibration—just plug it into your interface and it is ready to take readings. Due to its wide measurement range, the O₂ Gas Sensor can also be used to monitor oxygen concentration during human respiration. Included with the O₂ Gas Sensor is a 250-mL bottle to be used as a respiration chamber for studying plants and insects, or rusting of iron.

Specification
Analogue sensor
Range: 0 to 27% (0 to 270 ppt)
Accuracy: $\pm 1\%$ Volume O₂

Code:HSO2

pH sensor



Description
The pH Sensor is a Ag-AgCl combination electrode with a range of 0 to 14 pH units. This high quality electrode has many uses in chemistry, biology, at GCSE and above, as well as water quality monitoring in Geography. Included is a convenient soaking bottle with storage solution. An additional range of accessories including pH Buffer Capsules and pH Storage Solution are also available.

Specification
Analogue sensor
Range: pH 0-14
Resolution: 0.02 pH units

Code:HSPH

Radiation monitor



Description

The Radiation monitor consists of a Geiger-Mueller tube and rate meter mounted in a small, rugged, plastic case. The unit is battery operated and can be used without a computer for measurement of alpha, beta, and gamma radiation. It can be used to explore radiation statistics, measure the rate of nuclear decay, and monitor radon progenies.

Specification
Analogue sensor

Code:HSRM

Relative humidity sensor



Description

The Relative Humidity Sensor contains an integrated circuit that can be used to monitor relative humidity over the range 0 to 95% ($\pm 5\%$). This sensor can be used for weather studies, monitoring greenhouses, or for determining days when static electrical discharges could be a problem.

Specification
Analogue sensor
Range: 0% to 95%
Typical Accuracy: $\pm 5\%$

Code:HSRH

Respiration monitor belt



Description

Our Respiration monitor belt is used with our Gas pressure sensor to measure human respiration. Simply strap the belt around your chest, then pump air into the belt with the hand bulb. You can then monitor the pressure associated with the expansion and contraction of your chest during breathing. (Requires our Gas pressure sensor product code HSGPS.)

Specification
Analogue sensor

Code:HSRMB

Rotary motion sensor



Description

Our Rotary motion sensor lets you monitor angular motion accurately and easily, and is direction sensitive. Even though we call it a Rotary motion sensor, it can also be used to measure linear position to a fraction of a millimeter by simply rolling the pulley of the sensor along a table. The Rotary Motion Sensor was designed in collaboration with the Center for Science and Mathematics at Tufts University, USA.

Specification
Analogue sensor
Resolution: 1 degree
(angular velocity up to 13 rev/sec)

Code:HSRMS

Temperature probe



Description

This rugged and durable temperature probe has a sealed stainless steel shaft and tip that can be used in organic liquids, salt solutions, acids, and bases. The reading from the temperature probe is the resistance value of a thermistor.

Specification
Analogue sensor

Code:HSTMP

Also available is an extra long temperature probe with wider range: see our web site for details.

Thermocouple



Description

For systems that require measurements of more extreme temperatures, we have this sensor that uses a type-K thermocouple wire to measure the difference in temperature between its two junctions. It can be used over the range of -200°C to 1400°C ($\pm 10^\circ\text{C}$).

Specification
Analogue sensor

Range: -200 to 1400°C when used with reference junction in ice bath
Typical accuracy: $\pm 10^\circ\text{C}$
Range: -200 to 0°C when used with probe junction in ice bath
Typical Accuracy: $\pm 20^\circ\text{C}$

Code:HSTCA

Turbidity sensor



Description

Use our Turbidity Sensor to measure the turbidity of freshwater or seawater samples. Its small, sleek design and simple setup make it easy to use at the collection site or when you return to the classroom. The Turbidity Sensor measures turbidity in NTU (the standard unit used by most water collection agencies and organizations). Calibration can be done in about one minute using a high quality Hach StablCal® 100 NTU standard (included). Also included is a high-grade glass cuvette for the water sample to be measured.

Specification
Analogue sensor
Range: 0 to 200 NTU
Resolution: 1 NTU

Code:HSTRB

Microphone



Description

Our Microphone can be used to display and study the waveforms of sounds from voices and musical instruments. It is also great for speed of sound experiments.

Specification
Analogue sensor

Code:HSMCA

CO₂ Gas sensor



Description

The CO₂ Gas Sensor measures gaseous carbon dioxide levels in the range of 0 to 5000 ppm. This probe is great for measuring changes in CO₂ levels during plant photosynthesis and respiration. With this sensor, you can easily monitor changes in CO₂ levels occurring in respiration of organisms as small as crickets or beans! The CO₂ Gas Sensor is easily calibrated using a calibration button. A chamber with probe attachment is included for running controlled experiments with small plants and animals.

Specification
Analogue sensor
Range: 0-5000 ppm
Output signal range: 2.5 V

Code:HSCO2

Other sensors

Other sensors that are available include:

UV sensor

Ammonium Ion-Selective Electrode (with amplifier)

Calcium Ion-Selective Electrode (with amplifier)

Chloride Ion-Selective Electrode (with amplifier)

Nitrate Ion-Selective Electrode (with amplifier)