The above setup can be used to investigate the growth of a plant - runner beans often make the best type of plant to study as they are fast growing; often with a single shoot.

A thin thread can be attached to the plant using a small amount of super glue or similar quick drying glue. The other end is tied or glued to a wire passed through the hole in the sensor (in a similar way to the pendulum investigation) - it is important that both ends are well secured as the thread slipping can cause incorrect measurements.

The counterweight should be just heavy enough to keep the thread taught without actually snapping the thread or pulling too hard on the plant.

By adding sensors such as light, temperature or humidity you can study the key periods of the day and factors that effect plant growth.

Air Resistance:
A similar set up to that for the pendulum experiment can be used to look at the effect of air/wind resistance. Keep the length of the pendulum the same but try different shaped bobs such as flat, rounded, pointed. (Note: the length of the bob effects the pendulum length and so the centre of gravity must be kept the same to ensure fair testing).

Some more examples are:

- Expansion / elasticity of materials
- Rise of bread dough
- The roughness of a surface - fix the sensor to a stand with a length of wire connected and hanging down; pass a piece of material underneath and the sensor will pick up any mounds or troughs.
- Breathing rate - connected to spirometer or similar device

Note: Some experimentation may be required to find the best settings on your software/hardware such as log rate and axis scaling for the various investigations.

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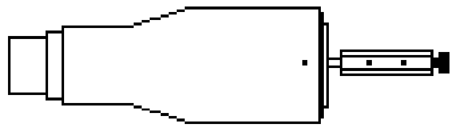
LogIT ❏❏ Movement & Position Sensor



❏ Introduction

The Microsense® Movement & Position Sensor contains a low torque potentiometer which can be used to measure angular position from 0 to 340 degrees, although the sensor can actually rotate continuously through 360° (there is an electrically 'dead' area for 20° of the span). It works with all LogIT products which support Microsense® DIN plug sensors.

❏ Instructions for use

A hexagonal sleeve is fixed to the spindle which has a small hole passing through it and a locking screw in the end. An alignment point has been indented on both the sensor body and hexagon sleeve - when lined up these points are at approximately 180° of the sensor's rotational span. This is to aid positioning of the sensor but for absolute accuracy you should connect the sensor to a LogIT data logger and then check the readout via it's display or software.

The spindle can be coupled to the object being measured in a variety of ways.

To measure the position of another spindle directly the two may be linked by a rubber sleeve which will avoid strain being placed upon the sensor's shaft and bearings. Alternatively stiff wire, such as piano wire, can be placed through the hole in the shaft and fixed in position using the locking screw. The wire can then be attached to a plant and counter weight to measure plant growth or a mass can be placed on the end to turn it into a pendulum. The sensor can be plugged directly into a LogIT data logger or a sensor extension cable can be used.

❑ Care

- This sensor is precision engineered which requires care in handling & use.
- Never exceed mass loads of more than 50 gms max. on spindle or bearings.
- Keep free from damp & extreme temperatures.
- Do not disassemble.

❑ Specification

- Rotation span: 360° continuous (340° measured)
- Torque: 0.25oz-in. max
- Backlash: 0.1° max
- Maximum holding load: 50 gms.

❑ Experiment ideas

The Movement and Position Sensor can be used for a wide variety of tasks other than just the measurement of an absolute angle.

The following are a few ideas for investigations which can be carried out using a LogIT data logger, Movement & Position Sensor and suitable software. In most cases it is easier to use the Movement and Position Sensor with a sensor extension cable to allow the sensor to be held in a clamp on a retort stand.

Harmonic motion - Pendulum:

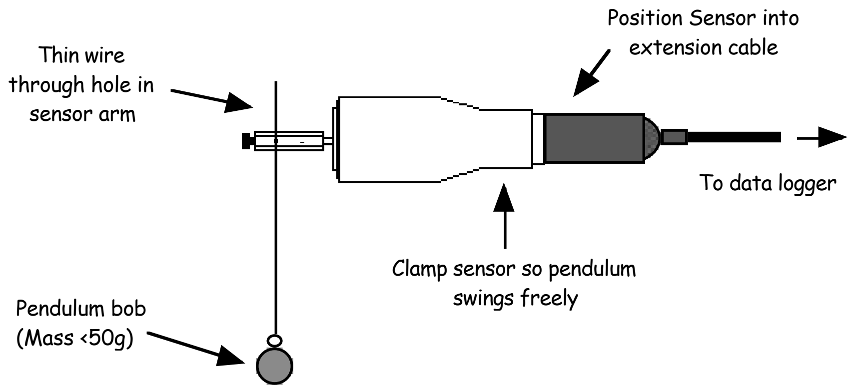
Throughout everyday of our lives, we see the effect of oscillation: car suspension, a plucked guitar string, even a loudspeaker. In all cases, the motion of the object follows the same path each time, eventually returning to the original position.

A simple pendulum (like that of a 'grandfather clock') is an easy way to study oscillations, or simple harmonic motion. You can use the Movement & Position Sensor to find out what effect length, l, of a pendulum has on the period, T, of oscillation i.e. how fast the pendulum swings.

Clamp the sensor in a retort stand and make sure that the dot on the arm of the sensor lines up with the dot on the body of the sensor and these are both pointing down.

Choose a bob which is of high mass (*max allowed weight is 50g*) and use fine wire to support the bob. One end of the wire is placed through the hole in the sensor arm and locked in place using the screw provided. The other end of the wire should be attached firmly to the bob.

It is important that the pendulum does not swing through too great an angle, so try a few 'dry runs' to set up the equipment. When the equipment is ready start the pendulum swinging then commence logging.



You only need to log for a short time, about 15 to 30 seconds to obtain a usable set of data (for best results log remotely and download the results). The investigation can then be repeated with a different length of pendulum (it is important to use the same start point as the previous run to ensure fair testing). As an extension to this exercise change the mass or size of the bob used but keep the length of the pendulum the same.

Auxanometer - Plant growth: