Using the Distance IR and Force sensor

These teachers notes are designed to show:

- How to setup the Distance IR sensor using Datadisc.
- How to investigate the laws of motion using the ScienceScope Distance sensor, Datadisc and a ***Logbook*** datalogger.

Setting up the IR Distance sensor

Before the using the Distance sensor, it is useful to familiarise yourself with the method of operation:

- ✓ The Distance IR sensor works by emitting an infrared signal which is then reflected off the object to be measured. The sensor measures the angle between the emitter and the receiver in the sensor and for this reason the sensor provides a non linear output. The ***Logbook*** dataloggers line arise the data so that it measures directly in mm. To achieve the best results the object to be measured should be made of or covered in a good reflector (preferably white). The accuracy of the sensor is best in the range 200 to 1000mm. The sensor has a PP3 type battery installed. The sensor switches on and off automatically when connected to a Logbook datalogger. When the battery needs replacing a warning light (red) illuminates on the front of the sensor case. To replace the battery undo the two screws on the top of the case and gently pull the top off. The battery can then be changed by unplugging the old one and inserting a new one.
- ✓ To see how to use the Distance IR sensor connect it to a ***Logbook*** datalogger. Connect the a Logbook datalogger to the computer and run Datadisc, see the Teachers' Guide for help if you need it at this stage. Select the meter in Datadisc.
- ✓ The sensor updates the output about 20 times per second. As a result it is recommended that for logging from this sensor that the recording interval is set to 50ms or more.

Setting Up The Force Sensor

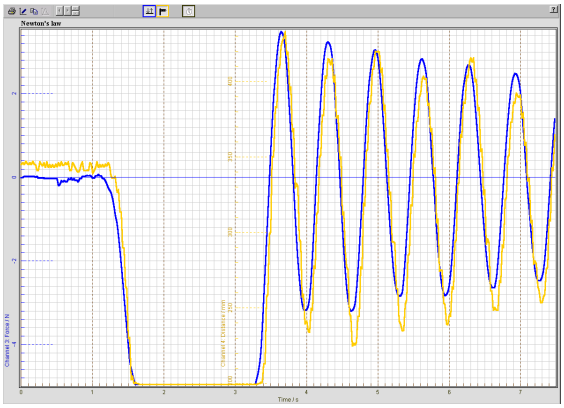
Before the using the Force Sensor, it will be useful to familiarise yourself with the features which make this such a versatile sensor:

- ❖ Please note that the normal maximum working load of the sensor is 50 Newtons, and that any force greater than 100 Newtons will ***irreparably*** damage the sensor. To give you a gauge, a ping pong ball, dropped from 10 cms generates an impact force equal to around 10 Newtons (a bag of sugar equivalent weight force – try the experiment described below).
- ✓ The Force Sensor has a default zero position, which allows for ± 50 Newtons to be applied to the sensor.
- ✓ After a force has been applied the sensor can be re-zeroed using the zero button on the sensor case. The sensor is designed to measure dynamic forces and the zero point can change slightly between recordings. Static recordings should be carried out using the Force Meter (S1800).
- ✓ Connect the Force Sensor to a Logbook datalogger and start Datadisc. Select the meter window from the toolbar or the 'measure' menu. If you need assistance Setting-up a Logbook Datalogger, see the Teachers' Guide.
- ✓ The buttons in the Meter of Datadisc Pt allow the sensor to have 9.8N set to allow calibration if needed, using a 1Kg mass, and for the values from the sensor to be inverted.
- ✓ There is a threaded stud on the sensor onto which you can screw a small platform adapter or a hook adapter.
- ✓ The hole on the sensor allows a Clamping Stud to be screwed in place and the sensor attached to a stand boss.

An investigation of the relationship between force and extension of a spring

Using Datadisc, the Force sensor, and the Distance IR sensor, it is possible to investigate how the force on a spring varies with extension and oscillations. To carry out this simple investigation proceed as follows:

1. Arrange the Logbook force sensor on a retort stand and clamp, and attach both springs provided with the Force sensor accessory kit, connected in line, to a mass of around 500g with a white card to act as a reflector attached to the bottom of the masses.
2. Place the Distance Sensor about 400mm below the masses on the spring and connect both this and the Force sensor to a Logbook datalogger and then start Datadisc in the metering mode.
3. Screw the end cap into the body of the sensor until it reads zero.
4. Start the 'record' dialogue from 'measure', check 'choose interval and number of points', set the interval to 20 milliseconds, and press 'Go'.
5. Then press the green button and pull the mass down about 200mm.
6. A typical recording is shown in the graph.
7. This allows students to calculate the spring constant k for Hookes law.



Equipment List:

- A ***Logbook*** datalogger, a connection to the computer, a PC computer with **Datadisc** software installed.
- A ***Logbook*** Force Sensor and accessory kit.
- A ***Logbook*** IR DIstance sensor
- A retort stand
- A piece of white card