Electronics Design Guide 1: Inputs

Sensing input signals

All electronic products make use of input signals and you will need to think about the way these signals are produced and sensed. Sometimes you will use a sensor and you will need to decide which one to use. There are electronic sensors to detect changes in a large number of variables:

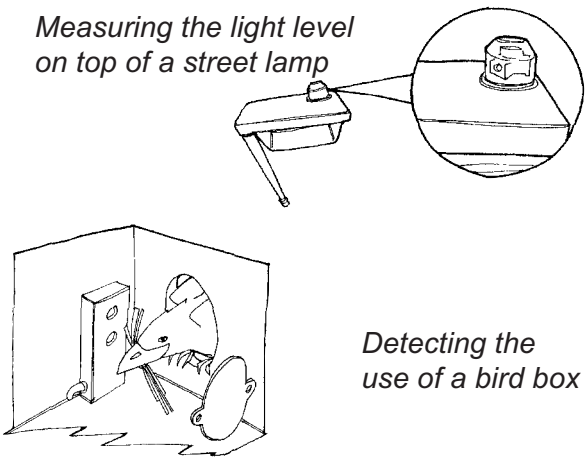
- temperature;
- sound level;
- pH;
- force;
- light level;
- moisture content;
- magnetic field;
- movement.

The different sensors that are available are described in the Sensors Chooser Chart, which can be downloaded from xxx.

Sensors are not the only input signals to think about. The product may also need:

- a switch to turn it on or off;
- a reset switch if the product latches or counts;
- an emergency or safety stop;
- a sensitivity adjustment (variable resistor);
- a selector to switch between different sensors;
- a selector to switch between output signals;
- a test button.

Two applications using a light dependent resistor



Measuring the light level on top of a street lamp

Detecting the use of a bird box

You can use these question to help you to decide on which sensor to use.

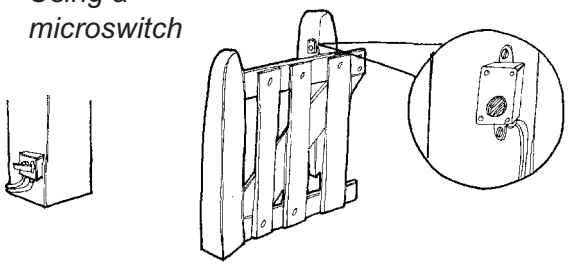
Technical questions

- What change does the sensor need to detect?
- Which sensors detect this change?
- Does the system require an analogue or digital signal from the sensor?
- How accurate does the sensor need to be?
- How reliable does the sensor need to be?
- Does the sensor need to be directional?
- Will the sensor be remote from the product?
- How much room is available for the sensor?
- What other signals might confuse the sensor?
- What environmental conditions will affect the sensor?

Non-technical questions

- How much do possible sensors cost?
- Will the sensor be seen or hidden?
- If seen, which sensors provide the right image for the product?

Note that it is possible to use one sensor for many applications and to meet the requirements of one application with different sensors, as shown below.



Using a microswitch

Using the shadow of the gate on a light sensor

Two ways to detect a gate being opened

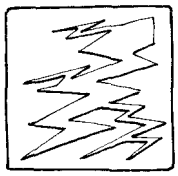
Electronics Design Guide 2: Outputs

There is a huge range of different electronic output devices. It is easy to get confused, so the first step is to use the following list to decide exactly what sort of output you need. Is it:

- sound;
- movement;
- magnetism;
- force;
- a display;
- light for illumination;
- light for indication;
- radiation for signalling;
- electrical switching;
- fluid flow?

Once you have made this decision, you can use the Output Transducers Chooser Chart to decide exactly which output device you need. Whichever one you choose, there will be other considerations to take into account. Use these points to help you.

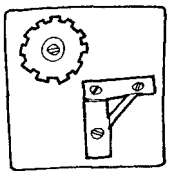
Electrical considerations



Take care to ensure that the power requirements of your output device can be met by your power supply. You may need to calculate the power available (I x V) and compare this with the power rating of possible output devices.

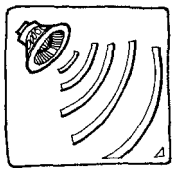
If the device is battery operated take care to ensure that the battery you are using will have a reasonable life. You will need to know the current drawn by the output device and the capacity of the battery, see the Power supplies Chooser Chart.

Structural and mechanical considerations



The output device must be an appropriate weight, size and shape to be fitted into the product. It must be robust enough to deal with the environmental conditions in which the product will be used. In the case of motors, it is important that they are fastened in ways that do not cause undue vibration.

Communication consideration

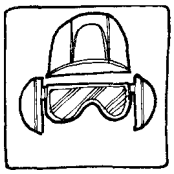


Some aspects of the choice of output components for a product may depend on how you want to communicate to the user. Here are some possibilities:

- a silent output to avoid disturbing or alerting others;
- a loud output to attract attention;
- an output that can be detected by those with a sensory handicap;
- a highly visible output suitable for public display.

Safety considerations

You will need to carry out a hazard analysis for the use of your design and identify any risks associated with its use.

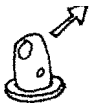
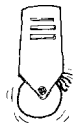
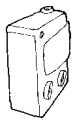
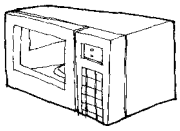
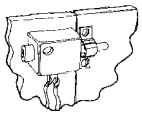
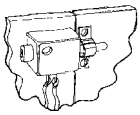
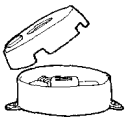
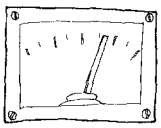


Your design should include ways to minimise these risks. Here are some examples.

- Moving parts – make sure that users are warned of any dangers.
- Sound levels – don't produce sounds that could damage hearing or contravene environmental protection rules.
- Temperature – users should be protected from, or warned about, devices that get hot.

Electronics Design Guide 2: Outputs

Here are some ways of using common output devices to communicate information.

LED 	Low power, easy to see in the dark, but more difficult in bright light. Different colours available. Can also be bought grouped either as 'bar graph' or square array.	Bell 	Higher power and much louder noise than buzzer. 
Flashing LED 	As above, but the flashing draws attention to it. 	Loudspeaker	For reproducing audio signals to be heard in an open space. 
7-segment LED display 	As LED above, for displaying LED display numbers or letters. 	Earphone 	For reproducing audio signals to be heard by a single individual without causing annoyance to others. 
7-segment liquid crystal display 	As above but liquid crystal display (LCDS) use much less power than LEDs. Only visible in reasonable lighting. 	Motor	Can be used to provide simple rotary movement or drive a mechanism to give a dynamic display. 
Lamp	Higher power but more visible than LED, produces heat, can be used to illuminate a sign, different colours achieved using filters, flashing needs to be done electronically. 	Solenoid	Can be used to switch a mechanism between two states. 
Buzzer 	Low power, intense monotone sound at short distance, pulsing improves ability to hear it over a distance 	Meter	Low power. For showing the size of an analogue signal. Particularly useful for showing slow change in a signal. May need to be calibrated. 
Siren 	Similar to buzzer but sound output is louder and frequency modulated. Requires a higher current.