Electronics Design Guide 8: Security devices

A security device is used to keep something valuable safe. It warns the owner if someone tampers with it. Or it may provide an alarm when it detects a danger – a child who has wandered off or the presence of an intruder. These devices often use proximity sensors.

Situations

Many security products are already on the market so look for gaps in the market and find situations where few, if any products, are available.

Sensing input signals

With a tamper alarm you can keep sensors hidden to stop a thief avoiding them – or make them obvious to put thieves off. If the leads to a sensor are cut, the alarm should be triggered.

You can make your own tamper sensors from a range of materials. Tamper alarms may use a code, input through switches, to arm and disarm them.

A proximity alarm may be triggered when something is either too close or too far away. Infrared or ultrasound signals and sensors may be used.

Producing output signals

The output signal will alert the user to the danger. A tamper alarm may have some of the following additional features:

- an intrusive signal to attract the attention of other people and to deter the thief;
- a delay to allow the user to deactivate the alarm or to provide time to catch the thief.

Remember that there are rules about the duration and volume of noisy alarms.

Electronic processing

Your alarm will need some of the following features:

- **A latch to keep the alarm on once triggered**

  A thyristor will provide simple latching on an analogue signal and also act as a driver for the output device. For more complex digital systems use a digital latch. Don't forget to include a reset.

- **A delay after triggering**

  Use either an RC network or a digital delay.

- **Coding and decoding of arm and disarm**

  Input from a keypad can be coded using digital logic. You could arrange for the alarm to be triggered if the wrong code is entered.

- **High frequency pulse generator**

  For use with ultrasound transmitters. The frequency should be around 40 kHz. Use matched receivers and transmitters for ultrasonic or infrared proximity sensors.

- **Programmable ICs**

  For a complex digital circuit, program the alarm control into a single IC.

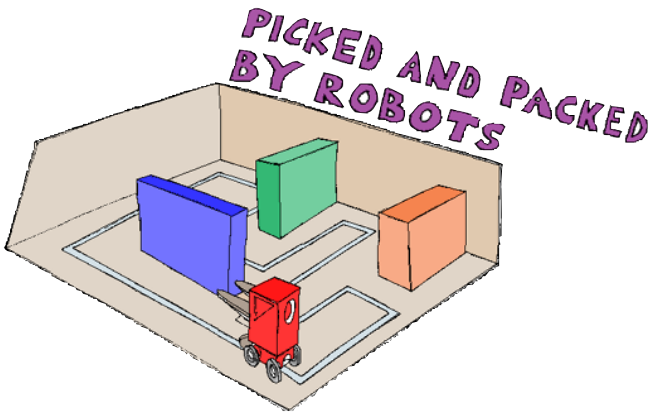
Electronics Design Guide 9: Control systems

To control something effectively, you need to do more than simply switch outputs on and off, you need to know the effect of this switching. The results of the output need to be fed back into the control system.

Situations

Control systems are important in many manufacturing situations which you can investigate by producing a small-scale version of the factory with the same control features. This is often the way such control systems are designed. Many warehouses use robot fork lift trucks to access stock. You can investigate the control systems required by using small scale models and simulation. Museums are using animated figures to bring their exhibits to life. They all use mechanical and electronic control.

You need to think about what you want to control and what the control has to achieve.



Sensing input signals

Significant inputs for your control system will be feedback signals, giving information about how effective the control is. Without feedback, control is inaccurate so the inputs will depend on what you are controlling, as shown below.

- In temperature control temperature will be an input.
- If the system is controlling movement, the amount of movement will be an input.

Digital sensors can be used where the output of the control system has to be kept within limits. For more accurate control use analogue sensors.

Producing output signals

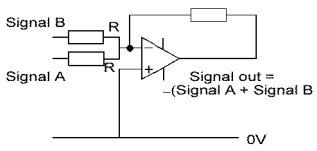
The output of a control system will be matched to what you are controlling, for example, a heater for controlling temperature or a motor for movement.

Electronic processing

Your control system will need some of the following features:

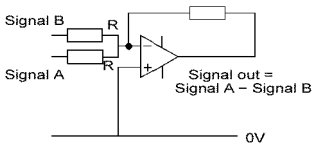
- **Comparison of reference and feedback signals**

  For analogue control use an op-amp configured as either a summer or difference amplifier. For digital control with an analogue input use a comparator. To combine digital signals use logic gates.



Op-Amp configured as a Summer

(All resistances the same.)



Op-Amp configured as a Difference Amplifier

(All resistances the same.)

- **Analogue control of an output**

  A power amplifier will provide analogue control for a lamp or heater. For motors which run poorly at low voltages either use pulse width modulation (this involves pulsing the output on and off – the more time the signal is off the slower the motor will go) or a stepper or servo motor.

- **Programmable ICs**

  For a complex digital circuit, program the control system into a single IC.