The ALU!

- The processing unit (full name arithmetic, logic unit: ALU) is the 'brain' of the microcontroller.
- It operates by reading instructions from the ROM (Permanent program memory) and then carrying out the mathematical operations for each instruction.
- The speed at which these operations occur is controlled by the clock.

The Clock!

- The clock circuit within the microcontroller 'synchronises' all the internal blocks (ALU, ROM, RAM etc.) so that the system remains stable.
- The clock circuit is built into the microcontroller, but an external crystal or resonator is required to set the clock frequency.
- A typical clock frequency for use with a microcontroller is 4MHz, but speeds as high as 20MHz can also be achieved.
- With a clock frequency of 4MHz the microcontroller completes one million instructions a second!

ROM & RAM!

- Memory (ROM and RAM) Microcontrollers contain both ROM (permanent memory) and RAM (temporary memory).
- The ROM (Read Only Memory) contains the operating instructions (i.e. the 'program') for the microcontroller.
- The memory retains the information even when the power is removed.
- Most microcontrollers are one-time-programmable types, which mean the ROM can only be programmed once.
- The RAM (Random Access Memory) is used for storing information whilst the program is running.
- This memory is 'volatile', which means that as soon as the power is disconnected the contents of the memory is lost.

Buses.

- Information is carried between the various blocks of the microcontroller along 'groups' of wires called buses.
- The 'data bus' carries the 8-bit data between the ALU and RAM / Input-Output registers, and the 'program bus' carries the 13-bit program instructions from the ROM.

Input/ Output Circuitry

- Microcontrollers communicate with the outside world via pins, grouped together in 'ports', with up to eight pins in each port.
- Generally each pin within the port can be configured as an output or as an input, or can even be multiplexed to change functions as the program is running!