

FACTFILE: GCSE

Technology and Design

OPTION A: ELECTRONIC AND MICROELECTRONIC CONTROL SYSTEMS Unit 2.18 Microcontrollers (PICs)



2.18 Microcontrollers (PICs)

Learning Outcomes

You should be able to:

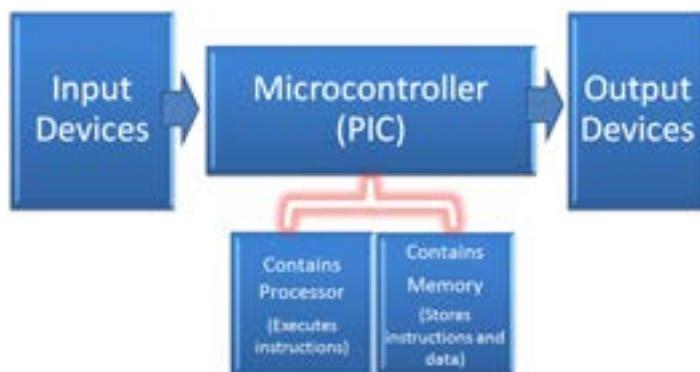
- show that they understand and can explain the use of microcontrollers (programmable interface controllers (PICs)) within control.

Course Content



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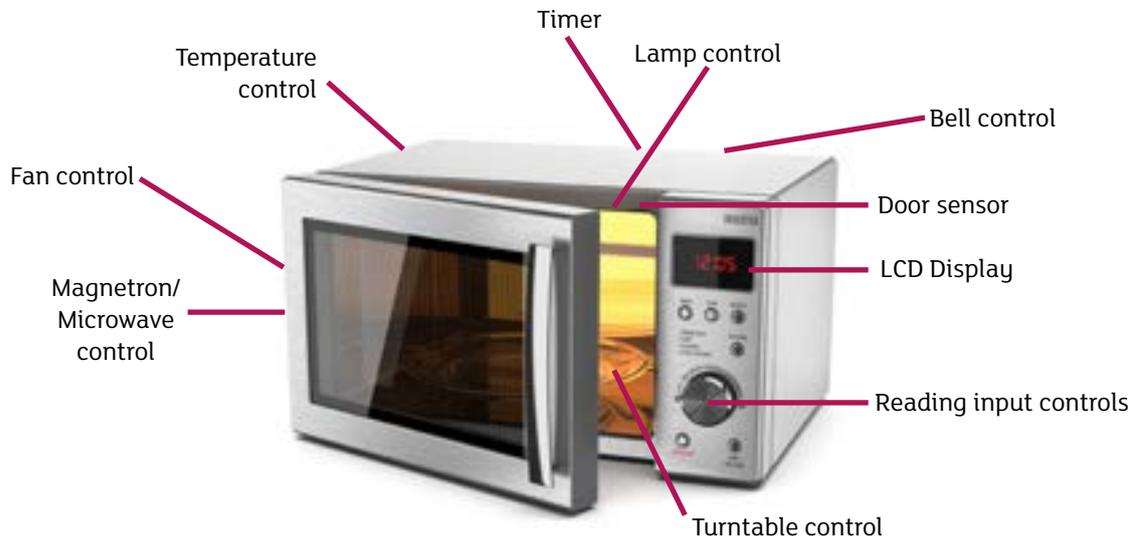
A microcontroller is often described as a 'computer-on-a-chip'. It is an integrated circuit (IC) that contains memory, processing units, and input/output circuitry in a single unit.



The key feature of a microcontroller is its capability of uploading, storing, and running a program. Microcontrollers are purchased empty and then programmed with a control program. Once programmed, the microcontroller is built into a product in order to control it.

Applications that use microcontrollers include household appliances, alarm systems, medical equipment, vehicle subsystems, and electronic instrumentation.

A microwave oven may use a single microcontroller to process input information from the keypad, display user information on the seven segment display and control the output devices (turntable motor, light, bell etc.). One microcontroller can often replace a number of separate parts, or even a complete electronic circuit.

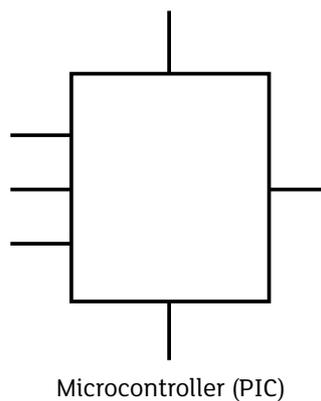


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What is a PIC?

Different microcontrollers are available from a number of manufacturers. One of the most popular microcontroller 'brands' is the PIC microcontroller (PICmicro) manufactured by Microchip. This microcontroller, commonly known simply as a 'PIC', is available in a number of different sizes (8, 18, 28 pin etc.). Quite often, microcontrollers from other manufacturers are also called PICs – a common mistake.

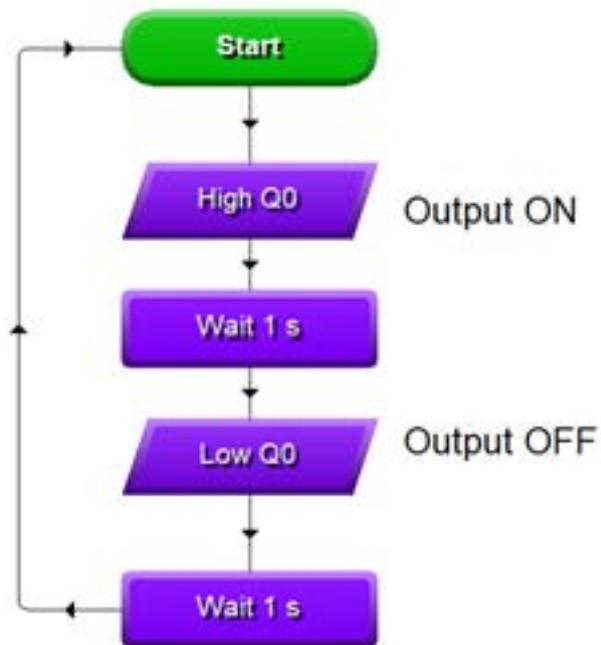
For the purposes of this specification, details of particular microcontrollers are not necessary. In a circuit diagram, a rectangle is used to represent the Microcontroller. Connections for input, output and power are added as required.



How is a microcontroller used?

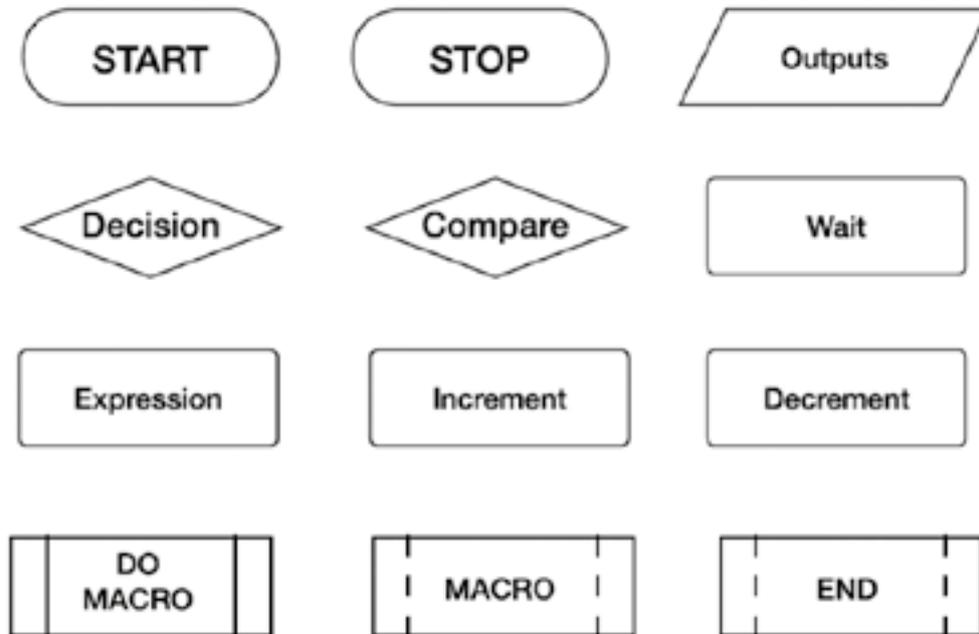
In a school context, particular educational software applications are used to write the program to be stored in the microcontroller. For the purposes of this specification we will only consider flowcharts although there are many programming languages used in primary and post-primary schools.

This is an example of a simple flowchart to switch an output on and off repeatedly.

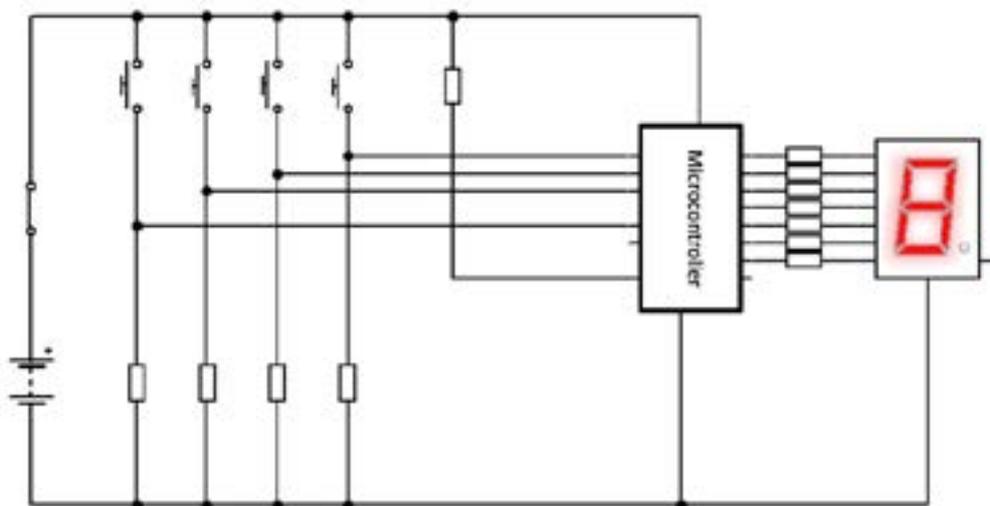


Flowchart Symbols

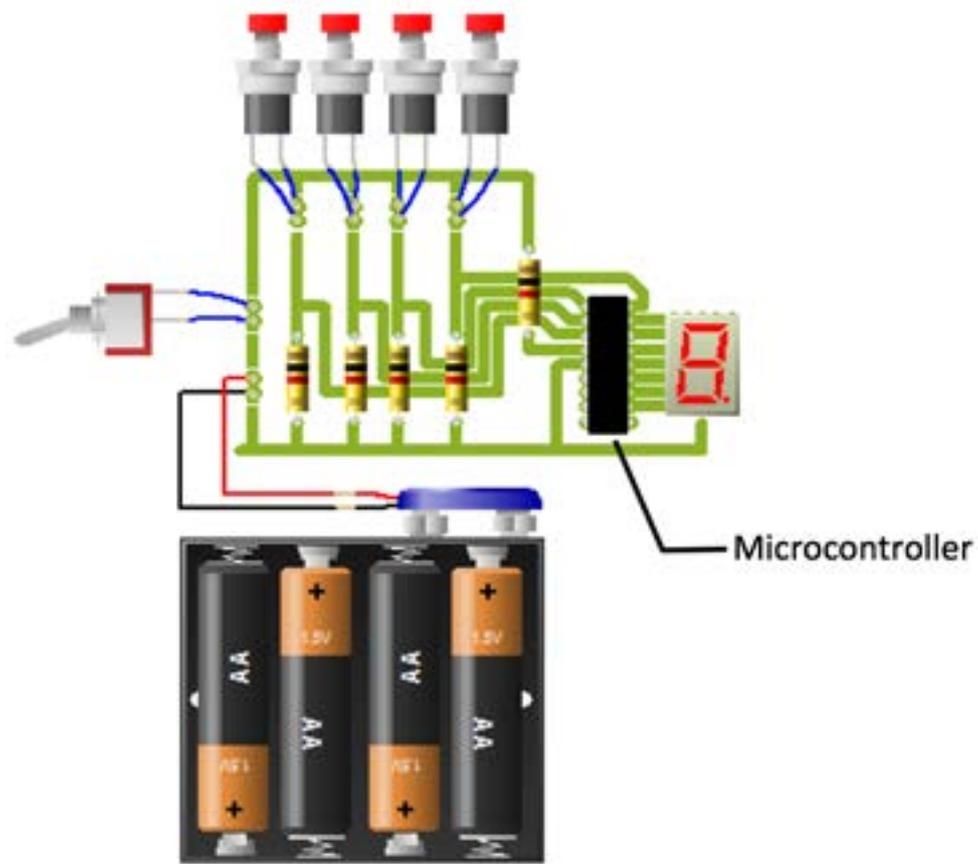
In order to avoid problems due to variations between computer control packages, only the following generic flowchart symbols will be used in examinations.



Once the flowchart has been written on a PC, it has to be transferred to the microcontroller. Some microcontrollers require the use of an expensive piece of hardware known as a programmer, but many educational microcontrollers may be programmed by inserting them in an inexpensive project board which can be connected directly to the PC. Once programmed, the microcontroller may be transferred to the project circuit board, power applied and the program tested.



Circuit Diagram with Microcontroller



Project Circuit Board with Microcontroller

Revision Questions

1. (a) In the construction of flow charts it is important to use the correct and appropriate symbols. Complete **Table 1** by inserting the correct name or drawing of the symbol.

Table 1

Symbol	Name of Symbol
	
	Expression or Increment
	
	Do Macro
	Macro

- (b) (i) Draw the electronic symbol for a microcontroller (PIC).

2. Part of a basic PIC microcontroller circuit is shown in **Fig. 1**. Insert on the part completed circuit in **Fig. 1**; the symbols for a 10 k Ω resistor at point A, an LDR at point B, a toggle switch at point C and a 1 k Ω resistor at point D.

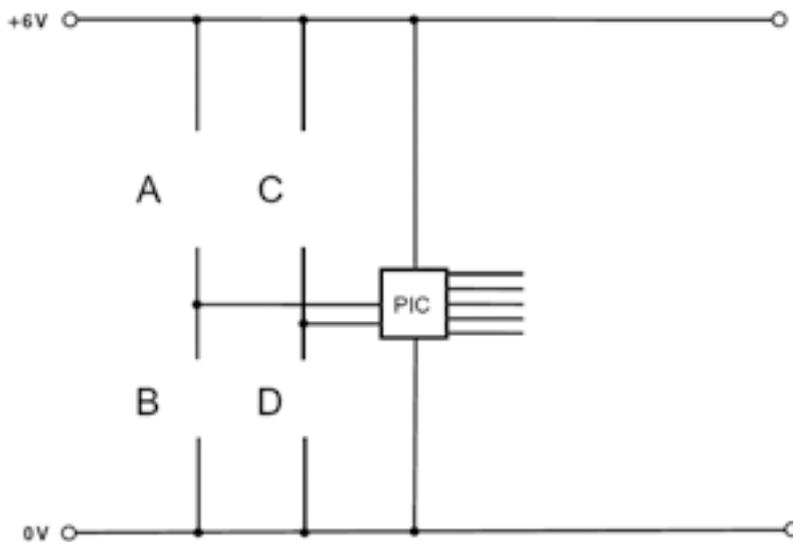


Fig. 1

Source: CCEA GCSE Technology and Design June 2013 Unit 2 Element 1 Q2(e)

