

CORE 1.7 PROGRAMMABLE COMPONENTS

- A flowchart shows the order in which a series of events is to be carried out. These are commonly used to program microcontrollers with instructions that control what the microcontroller will do.
- It is important that a designer knows what they want a product to do, then break it down into simple steps

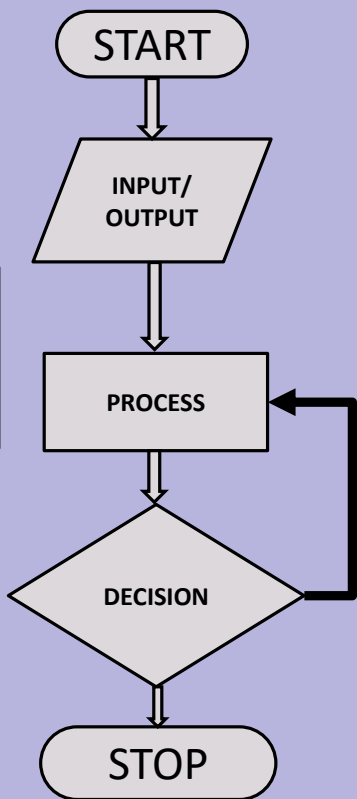
All flowcharts begin with the start symbol. This shape is called a terminator.

Inputs and outputs to the system are represented by a parallelogram box

A process box is used when there is an instruction that must be carried out. This may be an action or it may be a command to tell the microcontroller to wait before continuing

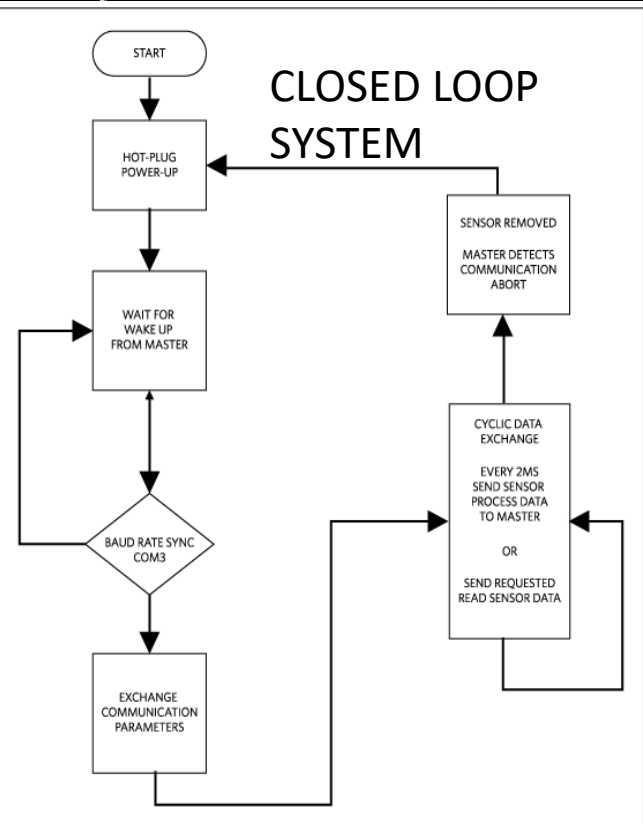
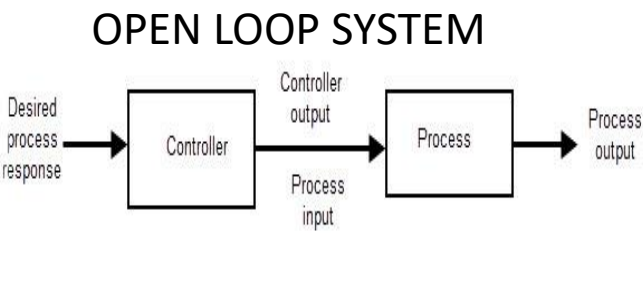
A diamond box is used when a decision needs to be made. This might include comparing the input states or comparing a count to a set limit. The outcome of the decision must be either yes or no. These can be in combination used to act as logic gates.

All flowcharts end with the end symbol. This shape is called a terminator.



Sequence arrows / flow line
The symbols must be linked by arrows which show the correct sequence of events.

As a designer, you need to know how to change /add to flowcharts to make the programme have different outcomes. In electronic systems you can use sensors such as LDRs and thermistors as inputs. You can also use time delays, counters and feedback loops on computer programs. Many programs are either an open loop system (that has no feedback), or a closed loop system, that has automatic feedback.



An electronic system uses questions in the program to make decisions

These decisions tell its output devices what to do

INPUTS

When an input is detected it moves to the next step and follows the next instruction. Some sensors give out an analogue signal such as LDRs and Thermistors. This means they give a range of values. Their resistance goes up and down as temperatures or light levels change. This means a system can be programmed to respond to different levels. In a LIGHT or DARK SENSING circuit, or in a HEAT sensing circuit, a variable resistor is used to set the light or heat level.



Using a flowchart

One example of a use of a simple flowchart is to control an automatic vehicle barrier at a carpark. The control system specifications are as follows:

- 1.A sensor detects an approaching vehicle.
- 2.Pin 1 checks if there is input from the sensor. If yes...
- 3.Output 0 lifts the barrier.
- 4.A second sensor detects the vehicle moving away from the barrier.
- 5.Pin 2 checks if there is input from the sensor. If yes...
- 6.Output 2 lowers the barrier



OUTPUTS

There are simple routines that can be added to a program to change what happens

TIME DELAY

"Wait 10" means the program will wait 10 seconds then go to the next instruction. You could make an LED flash on/off

COUNT

A program can be told to count how many times it gets an output, eg switch on the output after 10 pushes of a push button

FEEDBACK LOOP

This sends the program back to an earlier point in the program/system. Feedback loops allow you to monitor a sensor



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PROGRAMMABLE COMPONENTS

1 What are the 3 main parts of an electronic system?

3

2 What does the rectangular box mean in a flowchart?

1

3 What does the diamond shaped box mean in a flowchart?

1

4 What does a feedback loop do?

1

5 Draw a flowchart which switches a light bulb on when it gets dark and switches off when it gets light

Flowchart drawing area

4

6 Draw a flowchart that keeps a room at a set temperature of 21°

Flowchart drawing area

4

7 Which of the following could not input data into a system?

- Mouse
- LDR
- printer

1

8 Name a system that would use a time delay

1

9 Draw a flowchart of a system that would count the number of people entering a football match through the turnstiles, and alert the club when the match has reached full capacity.

Flowchart drawing area

4

4