Electronic Systems – These are systems that utilise discrete components to control events.

Input Subsystems

The input detects what is happening to the system.

Name & Image	Description & Symbol	Output
Switch	Push, slide, tilt, reed, vibration	Digital signal
Light Sensor	Output signal rises with light level	Analogue
Temperature Sensor	Output signal rises with temperature	Analogue
Moisture Sensor	Output signal rises with water content (humidity)	Analogue

Process Subsystems

The process subsystem analyses the signal and feeds into the output.

Name & Image	Description & Symbol	Output
Transistor MOSFET	An **amplifier magnifies** a small signal	Both
Thyristor	**Latch**, stays on until reset	Digital
Monostable	Once on stays on for a set time Uses 555 timer circuit	Digital
Astable	Continuously switches on and off Uses 555 timer circuit	Digital
Voltage comparator	Magnifies a small signal Using an Op-amp	Analogue In Digital out
Logic Gates	The output depends on the inputs (more below)	Digital;

Output Subsystem

The output is often a **transducer** which converts an electrical signal into a physical output

Name & Image	Description & Symbol	Output
Lamp	Emits light replaced with LEDs	Both
LED	Big selection of colours and sizes	Both
Buzzer Siren or piezo sounder	Single tone Loud = siren Range of tones = Piezo	Digital Digital wave
Loudspeaker	Sound waveform	Analogue
Motor	Motion	Both
Solenoid	Pulling force	Digital
Relay	Controls a higher voltage from a lower one	Digital

Timer circuits

If you want to vary when an event happens you can accomplish this by several methods.

Resistor - Capacitor circuit

$t=1.1RC$

t= time in seconds, R= Resistor Value in Ohms, C=Capacitance in Farads

ie R= 47KΩ C= 100µF so T= 1.1 x 47x10^3 x 100x10^{-6} =4.7 seconds (to 1d.p)

This **RC** circuit is highlighted to the right.

Logic Gates

The digital output of the logic gate is dependant upon the state of the inputs. **Truth tables** are used to find out how each gate behaves.

Not Gate

The not gate inverts the digital signal.

A	Q
0	1
1	0

And Gate

The and gate is only on if **both** input s are on.

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

Or Gate

The or gate is on if either input is on.

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

Nand Gate

The Nand gate is a not gate and an and gate together *ie* it is only off if both inputs are on.

Nor Gate

The Nor gate is a not gate and an or gate together *ie* it is off if either inputs are on.

Eor Gate

The Eor gate is only on if **only** one input is on.

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

Words

-System
-Sub-system
-Digital
-Analogue
-Signal
-Amplifier
-Magnifies
-Latch
-Truth table
-Op-amp
-Farads
-Pin
-Chip
-Triggered
-Frequency
-Pulse
-555 Timer
-MOSFET
-Variable
-Transducer
-gain

Logic gates can be combined to form more complex processes.

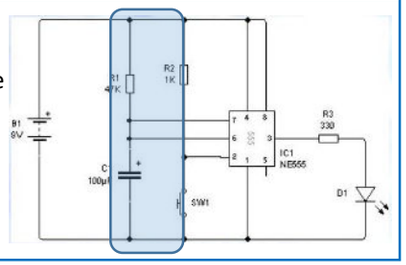
Gain is how much amplification a system has

$V_{gain} = V_{out}/V_{in}$

Design and Technology

Monostable

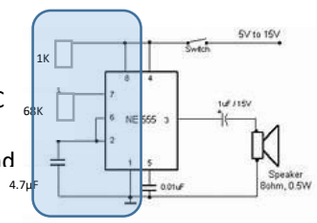
This circuit turns on for a period of time and then switches off, the time is determined by the **RC** circuit. The circuit is triggered by the switch on pin 2 of the chip. The LED will light then switch off after 4.7 sec.



Astable

Unlike the monostable the astable circuit continuously switches on and off. This **frequency (f)** in **Hz** is governed by the following values. As $t=1/f$ (sec) you can work out the time between pulses $f=1.44/(R_1+2R_2)C$ R_1, R_2 and C (highlighted on the right) R_1 = 1KΩ R_2=68KΩ C= 4.7µF

1.44/(1x10^3+2x(68x10^3)x4.7x10-6= 2.24Hz (to 2 d.p.) So the speaker will sound every 0.45sec to make an alarm. To make the sums easier R_1 is usually 1KΩ



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