

Binary

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When counting in decimal, if you see a number like 2,359 it can be broken down. Starting from the right, 9 in the ones column, 5 in the tens column, 3 in the hundreds column and 2 in the thousands column.

	< etc	digit 5	digit 4	digit 3	digit 2	digit 1
	< etc	10,000's	1000's	100's	10's	1's
		0	2	3	5	9

Computers count using binary. Bi- means two, so a digit can be in one of two states. It can be "on" or it can be "off". It can be "0" or it can be "1".

Counting in binary is like counting normally, except that the columns "double", as each column reaches its maximum number of values/variants.

< etc	256's	128's	64's	32's	16's	8's	4's	2's	1's	Decimal
< etc	0	0	0	0	0	0	0	0	0	0
< etc	0	0	0	0	0	0	0	0	1	1
< etc	0	0	0	0	0	0	0	1	0	2
< etc	0	0	0	0	0	0	0	1	1	3
< etc	0	0	0	0	0	0	1	0	0	4
< etc	0	0	0	0	0	0	1	0	1	5
< etc	0	0	0	0	0	0	1	1	0	6
< etc	0	0	0	0	0	0	1	1	1	7
< etc	0	0	0	0	0	1	0	0	0	8
< etc	0	0	0	0	0	1	0	0	1	9

So a row of 0's is equal to 0. Each one of the "columns" is a "binary digit", otherwise known as a "bit".

But a number like 137 is written 10001001 because it has 1 x 128's, 1 x 8's and 1 x 1's to make up 137, as written below.

< etc	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1
< etc	128's	64's	32's	16's	8's	4's	2's	1's
137 =	1	0	0	0	1	0	0	1

So an 8 bit counter can count as high as 255, because that is the highest number we can achieve if each of the "columns" has a 1 in it. In other words, $128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255$.

Our Arduino boards have 10 bit converters, so they count from 0 to 1023.

8 bits is also known as a byte.

(4 bits is obviously smaller, and is known as a nybble.)