Lego dimensions: the measurements

The Classic Bricks

There are five basic dimensions:

1. The horizontal pitch, or distance between knobs: 8mm.
2. The vertical pitch, or height of a classic brick: 9.6mm.
3. The horizontal tolerance: 0.1mm
   This is half the gap between bricks in the horizontal plane. The horizontal tolerance prevents friction between bricks during building.
4. The knob diameter: 4.8mm
   This is also the diameter of axles and holes. Actually a knob must be slightly larger and an axle slightly smaller (4.85 and 4.75 respectively, otherwise axles would not turn in bearing holes and knobs would not stick in them) but we will ignore this difference here.
5. The height of a knob: 1.8mm

As one can see, dimensions have even numbers after the decimal point.

These five basic dimensions are not "fundamental". Most dimensions are even multiples of 0.8mm.

Fundamental dimensions

1. 0.8mm is the base measure
2. 0.1mm is the play value in x and y
3. 1.8mm is the height of knobs

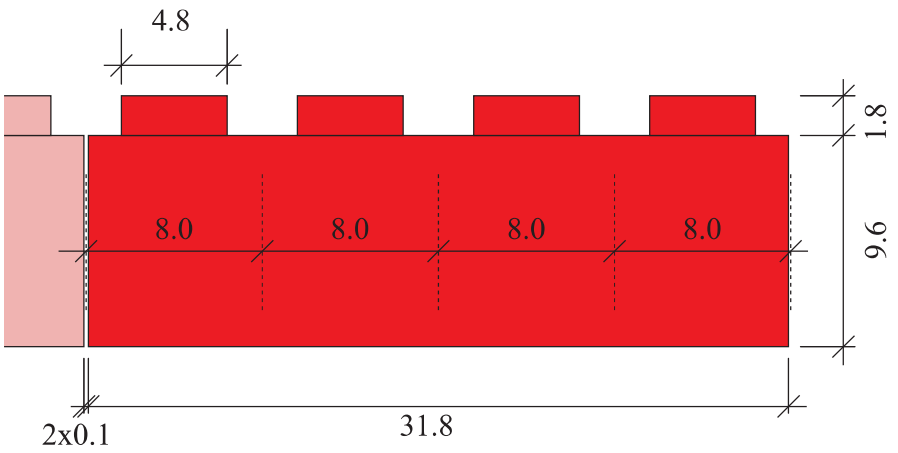
Multiple of base	Value in mm	Meaning
1	0.8	
2	1.6	
3	2.4	
4	3.2	plate thickness
5	4.0	
6	4.8	axle diameter; knob diameter
7	5.6	
8	6.4	two plates
9	7.2	
10	8.0	horizontal pitch
11	8.8	
12	9.6	vertical pitch; three plates
13	10.4	
14	11.2	
15	12.0	
16	12.8	
17	13.6	
18	14.4	

19	15.2
20	16.0

All measures are even multiples of 0.1mm except where they are derived. E.g. the width of a brick wall will be 1.5mm:

8.0mm (basic pitch) - 0.2mm (0.1mm play on each side) - 4.8mm (size of knob) = 3.0mm = 2x wall thickness.

A classic brick



In addition there is:

1. The distance of axle holes from the base: 5.8mm
   This is in fact a derived number.
2. The diameter of the recess of a Technics hole: 6.0mm and the recess amount of the same.

All other measures are derived from these.

From this follows that normal bricks have horizontal dimensions that are multiples of 8mm, and then minus 0.2mm.

Examples:

4 knobs brick: 4x8 - 0.2 = 32.0 - 0.2 = 31.8

6 knobs brick: 6x8 - 0.2 = 48.0 - 0.2 = 47.8

…

16 knobs beam: 16x8 - 0.2 = 128 - 0.2 = 127.8

A plate is 1/3 the height of a normal brick which therefore is 9.6/3 = 3.2

The other side of bricks: