Calculating Filament Flow Rate

Calculating the flow rate of your extruder is typically very easy. The equations you can use to calculate filament flow rate depends on your print settings and whether you are printing or not. Follow the *Extruding in Air* section to calculate the flow rate while extruding filament in the air and the *Printing Flow Rate* section in order to find the filament flow rate while printing.

Extruding in Air

When the extruder is printing filament into air, we can assume that the printer is creating a steady stream of filament at a slightly larger diameter than the diameter of the nozzle. If the extruder is not skipping, you can use the feedrate of the extruder move and the cross-section of the filament to calculate the flow rate. Because, all the filament that is being pushed by the extruder is pushed through the nozzle. Follow the equation below:

Flow Rate (mm^3/s) = Feedrate (mm/s) (Filament Cross-section) (mm^2)*

Filament Cross-section = pi ((Filament Diameter) / 2)^2 __Filament Cross-section for 1.75mm filament: 2.405 mm^2*

For Example: You send the command `G1 E100 F200` , where you extrude 100mm of filament at 200 mm/min. You are using 1.75 mm filament.

Flow Rate = 8 mm/s = pi (1.75 / 2)^2 (200 / 60) = 2.405 3.333*

Remember that the `G1` move command feedrate parameter, `F` , uses mm per minute. So divide the feedrate by 60 to obtain the feedrate in mm per second.

Printing Flow Rate

When printing, the flow rate depends on your layer height, nozzle diameter and print speed.

Flow Rate (mm^3/s) = (Extrusion Width)(mm) (Layer Height)(mm) Print Speed (mm/s) Extrusion Width is ~120% of nozzle diameter

For Example: You have a 0.5 mm nozzle mounted and you are printing at 0.25mm layer height at a print speed of 30 mm/s.

*Extrusion Width = 0.6 mm = 1.2 0.5 Flow Rate = 4.5 mm^3/s = 0.6 0.25 * 30*