Stepper Motor Step Angle, Resolution and Pulse Rate

Full and microstep angles of a stepper motor, linear resolution through a lead screw or belt, and the pulse frequency and speed for a linear feed rate.

Method: Stepper motor kinematics

Input parameters

Unit system: SI

Parameter	Value	Unit
Full steps per revolution	200.00	
Microsteps per full step	16.000	
Gear ratio (motor turns per output turn)	1.0000	
Travel per output turn (lead or belt pitch × teeth)	5.0000	mm
Required linear speed	50.000	mm/s

Calculated results

Parameter	Value	Unit
Full step angle	1.8000	°
Microstep angle	0.11250	°
Linear resolution per microstep	1.5625	µm
Pulse frequency	32.000	kHz
Motor speed	600.00	rpm

Notes for this case

• Step angle = 360°/N_s (1.8° for 200 steps); microstepping divides it electrically, but positional accuracy is still limited to a fraction of a full step by the motor's detent torque and load. Resolution = travel per output turn/(gear ratio × N_s × m); pulse rate = speed/resolution. Torque falls with speed, so check the motor's pull-out curve at the motor speed shown.

Formula and method

$$\theta_s = \frac{360^\circ}{N_s}, \quad \Delta x = \frac{p_l}{i N_s m}, \quad f_p = \frac{v}{\Delta x}$$

Variables

N_s	Full steps per revolution	-
m	Microsteps per full step	-
i	Gear ratio (motor turns per output turn)	-
p_l	Travel per output turn (lead or belt pitch × teeth)	m
v	Required linear speed	m/s
θ_s	Full step angle	rad
θ_m	Microstep angle	rad
Δx	Linear resolution per microstep	m
f_p	Pulse frequency	1/s
n	Motor speed	rad/s

Method and standards

Stepper resolution.

Assumptions and limits

- No missed steps; rigid transmission.

References

Stepper motor kinematics

Report details

Report reference	FCC-AD0F-VPX5 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/motors/stepper-motor-resolution

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.