G12-N20 Geared Mini DC Motor

This is a DC Mini Metal Gear Motor, ideal for making robots. Light weight, high torque and various RPM. Fine craftsmanship, durable, not easy to wear. With excellent stall characteristics, can climb hills easily. You can also easily mount a wheel on the motor’s output shaft. Widely used on boat, model car, robotic, home appliances and linear motion control.

SKU: EMH1176

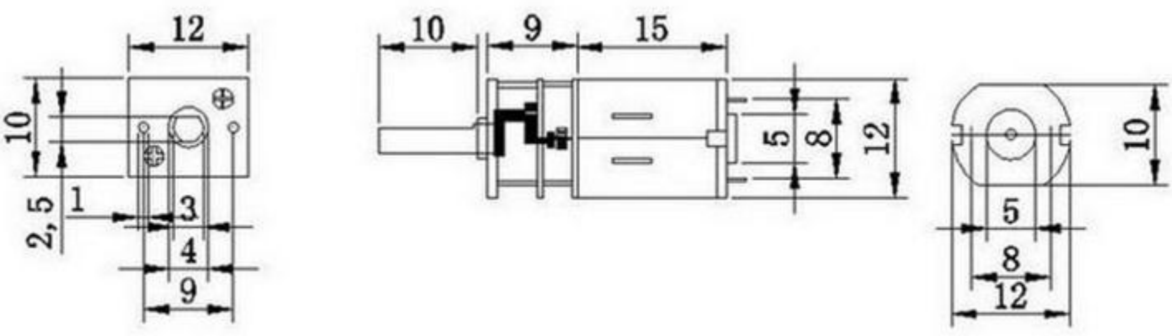
Brief Data:

- Model: GA12-N20.
- Medium Power MP: 0.5W Max.
- Rated Voltage: 6~12V.
- Revolving Speed: Refer to Table 1.
- Torque: Refer to Table 1.
- Rated Current: 0.04A.
- Stall Current: 0.67A.
- Total Length: 34mm.
- Gear Material: Full Metal.
- Gearbox Size: 15 x 12 x 10mm (LxWxH).
- Shaft Size: Ø3 x 10mm (D*L). D-Type Shaft.
- Net Weight: 10g.

Stalling this gear motor could cause gear damage!

Mechanical Dimension:

Unit: mm



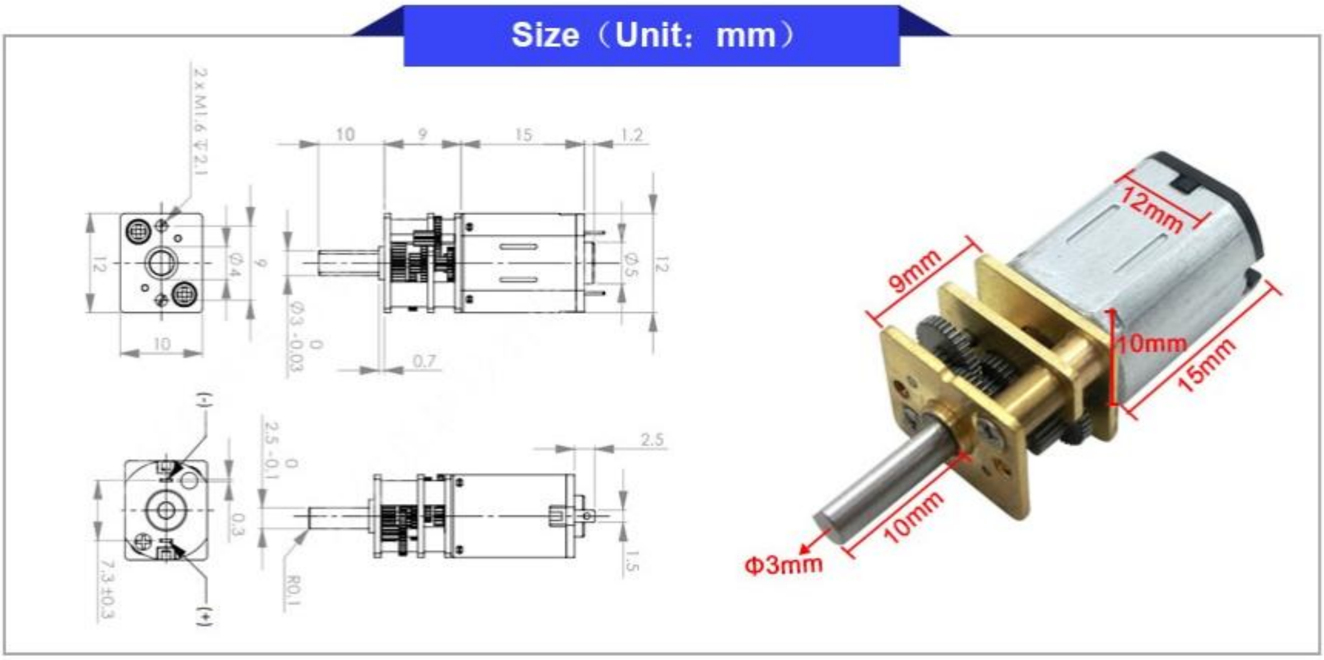
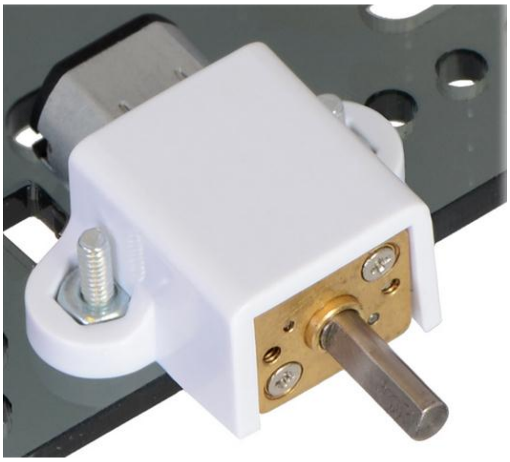


Table-1:

Model	No Load Speed RPM	Torque Max Kg.mm	Stalled Torque Kg.mm	SKU
GA12-N20-100	6V@100	3.4	17	EMH1176
	12V@200			
GA12-N20-200	6V@200	1.9	9.4	EMH1189
	12V@400			
GA12-N20-450	6V@450	1.2	5.4	EMH1190
	12V@900			

Application Examples:



Related Products:

- 42mm Rubber Wheels
- GA12-N20 Motor Mounting Bracket
- 68mm High Grip Rubber Wheel for Robotics Car

Application Note: Useful Motor/Torque Equations

Force (Newtons)
$F = m \times a$
m = mass (kg)
a = acceleration (m/s2)

Motor Torque (Newton-meters)
$T = F \times d$
F = force (Newtons)
d = moment arm (meters)

Power (Watts)
$P = I \times V$
I = current (amps)
V = voltage (volts)

$P = T \times \omega$
T = torque (Newton-meters)
ω = angular velocity (radian/second)

Unit Conversions
Length (1 in = 0.0254 m)
Velocity (1 RPM = 0.105 rad/sec)
Torque (1 in-lb = 0.112985 N-m)
Power (1 HP = 745.7 W)

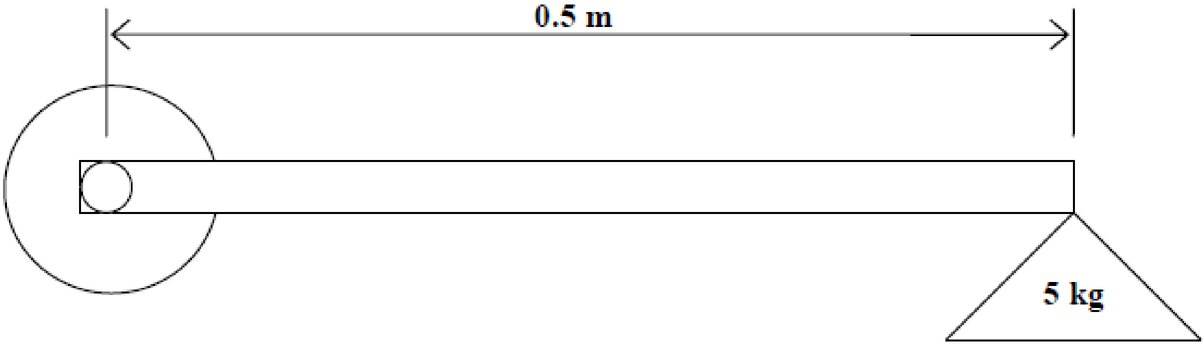
Example 1

Determine if the following motor can be used to lift a 5-kg load using a 0.5-m lever arm.

Merkle-Korff Gearmotor specifications

Stall Torque = 40 in-lb

Stall Current = 3.5 amps



Solution

Convert Stall Torque from in-lb to N-m

1 in-lb = 0.112985 N-m

40 in-lb = 40 x 0.112985 N-m = 4.5194 N-m

Calculate the Force required to lift the 5-kg load

F = m x a = 5 kg x 9.81 m/s2 = 49.05 N

Calculate the Torque required to lift the Force with the lever arm

T = F x d = 49.05 N x 0.5 m = 24.525 N-m

We cannot perform the lift with this set-up, because the stall torque is smaller than the torque required for the lift. We must either shorten the length of the lever arm, or we must choose another motor with a higher stall torque to perform this operation.

Example 2
Using the same motor as in Example 1 with a 12-V power supply:
a) Calculate the power used by the motor to rotate a 5-kg load at 50 RPM using a 3-inch lever arm.
b) Calculate the current draw from the battery to perform this operation.

Solution
Convert inches to meters:
1 in = 0.0254 m
3 in = 0.0762 m

Calculate the Force required to lift the 5-kg load:
F = m x a = 5 kg x 9.81 m/s2 = 49.05 N

Calculate the Torque required for this operation:
T = F x d = 49.05 N x 0.0762 m = 3.738 N-m

> Note- This toque is lower than the motor's stall torque, so this operation is possible using the specified motor, mass, and lever arm

Convert RPM to radians/second:
1 RPM x 2π rad/rev x 1 min/60 sec = 0.105 rad/sec
ω = 50 rev/min x 0.105 rad/sec/RPM = 5.25 rad/sec

Calculate the Power required for this operation:
P = T x ω = 3.738 N-m x 5.25 rad/sec = 19.622 W

Calculate the Current draw from the battery (use the supply voltage in this calculation):
I = P/V = 19.622 W/12 V = 1.635 Amps

Note- This current is smaller than the maximum allowable current draw of the motor.

Example 3
Determine the motor torque necessary to power the robot drive wheels.

Solution
The following approach is merely one way to solve this problem. Several exist.
Assume the robot will be powered by two powered drive wheels and supported by two freely rotating caster wheels. Robot weight is denoted by W and for this simple example we'll assume the weight is distributed evenly over all 4 wheels, as shown in Figure 1 below.

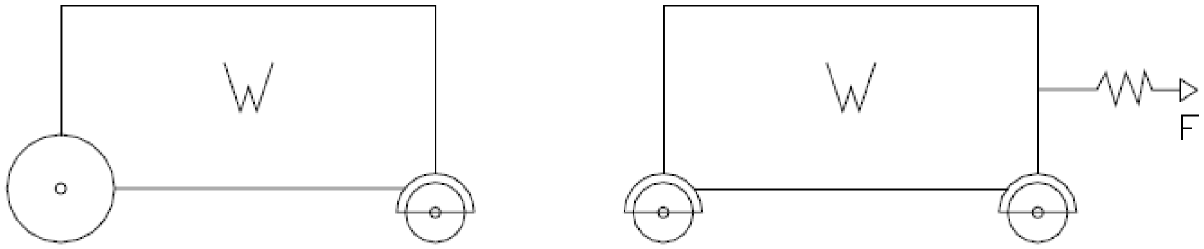


Figure 1 Figure 2

Thinking logically about the problem, we could model the robot as having 4 of the identical caster wheels (Figure 2) and the force required to propel the robot is simply the force needed to start the robot moving (this could be measured empirically with a force scale). The problem is we haven't yet built the robot so testing it in this manner is not an option. We need to calculate the force (and hence motor torque) required to move the robot **before** we build anything.
Looking closer at the caster wheel we can see the actual friction that must be overcome to put the robot in motion. Fw is the friction force between the wheel and the floor and Fa is the friction force between the wheel and the axle. Tw and Ta are the respective torques between the wheel and floor and the wheel and axle.

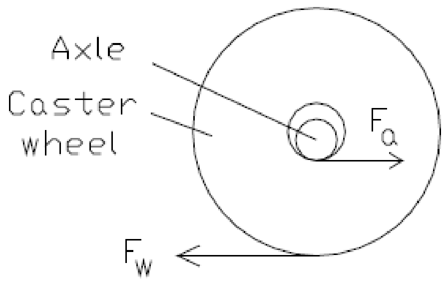


Figure 3

Fa = W/2 * µa
Ta = Fa * Ra
Fw = W/2 * µw
Tw = Fw * Rw
Tw is the *maximum* torque the wheel can transmit to the ground before it slips.

Our goal is to find a realistic range for Tm, the motor torque.
As calculated above, Tw would be the *maximum* amount of torque the motor could transfer to the ground before the wheel begins to slip (ie Tm, max).
Typically, we desire µw > µa, so the wheel does not slip/slide across the floor, but rather rolls. We can easily look up the µa value for the axle/wheel materials in contact. Knowing µa and the weight of the vehicle, Fa can be computed. This is the *minimum* amount of force we would have to provide at the wheel/axle interface to overcome the friction between the two. To relate the computed axle force Fa to the *minimum* amount of

wheel torque required to move the robot, we would use the "virtual radius" of the wheel/axle combination, which is computed as follows:

Rv = Rw – Ra

This is the fictitious radius about which Fa would act to rotate the wheel about the tangent point in contact with the ground at any instant, as shown in Figure 4 below.

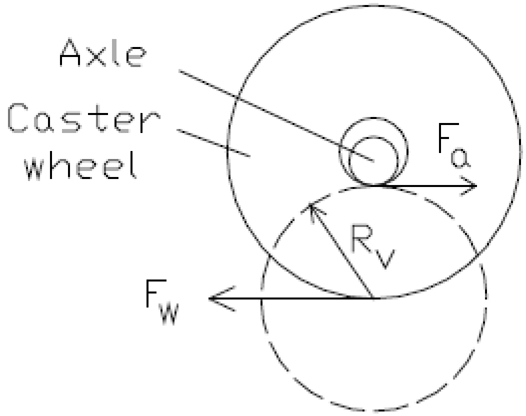


Figure 4

Therefore our equation for the *minimum* amount of torque the motor must transfer to the ground before the wheel begins to roll (thus causing the robot to move) would be:

Tm (min = Fa * Rv = Fa * (Rw – Ra)

In summation, Tm, min ≤ Tm ≤ Tm, max or alternatively, Fa * (Rw – Ra) ≤ Tm ≤ Fw * Rw

Motors, Fans and Accessories Selection

40x40x10 mm DC Brushless Cooling Fan

Ultra quiet powerful brushless DC fan, quiet sleeve-bearing design. Specialized design, professional made, stable performance. Operating Temperature: -10 C to +60C. Long Life Expectancy.

EMH-1071 GDT4010S12B RM 6.50

GA12-N20 Geared Mini DC Motor

This is a DC Mini Metal Gear Motor, ideal for making robots. Light weight, high torque and low RPM. Fine craftsmanship, durable, not easy to wear. Widely used on boat, model car, robotic, home appliances, linear motion control.

EMH-1176 GA12-N20 RM 18.50

30x30x10 mm DC Brushless Cooling Fan

Ultra quiet powerful brushless DC fan, quiet sleeve-baring design. Specialized design, professional made, stable performance. Operating Temperature: -10 C to +60C. Long Life Expectancy.

EMH-1070 GDT3010S12B RM 7.50

Nema23 Bipolar/Unipolar Stepper Motor 1.0A

A stepper motor to satisfy all your 3D-Printer, robotics, Linear Motion projects needs! This 6-wire uni-polar/bipolar stepper motor has 1.8° per step for smooth motion and a nice holding torque.

EMH-1179 23HS2610 RM 110.00

1.2A Nema 17 Stepper Motor

A stepper motor to satisfy all your 3D-Printer, robotics, Linear Motion projects needs! This 4-wire bipolar stepper has 1.8° per step for smooth motion and a nice holding torque.

EMH-1016 42HS40-1204D RM 44.50

1.7A Nema 17 Stepper Motor

A stepper motor to satisfy all your 3D-Printer, robotics, Linear Motion projects needs! This 4-wire bipolar stepper has 1.8° per step for smooth motion and a nice holding torque.

EMH-1181 17HS-4401SD RM 47.00

SG90 Tower Pro Gear Micro Servo Motor

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction). Good for beginners who want to make stuff move without building a motor controller with feedback & gear box.

EMH-1140 TPSG90S RM 7.40

Nema-17 Planetary Geared Stepper Motor

This high precision NEMA17 Stepper motor has an integrated Planetary Gearbox with 1:5.18 gear ratio, the resolution can reach 0.35°step angle.

EMH-1173 42BYGP40P RM 185.00

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