

MOTOR DETAILS

QUADCOPTER FUNCTIONAL REQUIREMENTS

- Carry a Load of 500g and Below (1 Pint of Blood = 495g)
- Weigh 800g (frame = 454g, Components = 878g)
- Weight 1.83Kg (Drone & Payload = 1.83kg)
- Recharge Backup Battery Using Oscillatory Motion of Motors & Solar Frame panels.
- Autonomous
- 4 Hours of Flight Time
- Remotely Stream live feeds via Camera
- 360 Camera View Via Servo Motor
- Flight Height of 10ft
- Switch between Power Sources During Functional Flight Mode.
- Take Pictures and Video then send to the Cloud.

COMPONENTS

- Frame
- Propeller
- **Motor**
- Electric Speed Controller
- Flight Controller
- Power (Battery)
- Transmitter & Reciever
- Camera

MOTOR

- Selecting the right motor comes down to weight, power, efficiency and torque, the importance of each of these are ultimately determined by your flying style and what you are trying to accomplish with your multi-rotor build.
- The most commonly built drones use direct current brushless electric motors instead of direct current brushed.

Below shows details of the Selected Motor for Quadcopter prototype.

EMAX MT2216 BRUSHLESS MOTOR
<p>Key Features:</p> <ul style="list-style-type: none">• Impressive multi rotor motor design.• Offers classic response performance.• Multi rotor options available like Octo, Hexa, Quad and Tri.• Maximum thrust goes up to 1100g. <p>This Motor is powerful enough to provide the required thrust needed to lift the weight stated in the Functionality requirement.</p>

GARTT 4pcs ML 2212 920KV Brushless Motor 2-4S

Key Features:

- High magnetic energy NdFeB magnet steel-N45SH with 150 degrees heat-resistant.
- To support the high speed(up to 15000 spin), we used the Imported Japanese NMB Bearing and HRC55 degrees stainless steel Axis
- Each rotor was balanced with high speed,ensure the motor high-speed running without shake.
- The vane-type design can reduce motor temperature with a stream of air.
- M3 shaft come with propeller adapter, recommend 9443 9450 self-locking propeller.

Specifications & Configuration:

Series : ML 2212

Motor KV : 920KV RPM/V

Motor Resistance (RM) : 0.1516 Ω

Idle Current (Io/10V) : 0.4A/10V

Max Continuous Current : 18A

Max Continuous Power : 230W

Weight : \approx 59g/2.08oz (one piece)

Lipo Cell : 2-4S

No. of Stator Arms : 12

Pole Count : 14

Motor Diameter : 28mm/1.1in

Motor Body Length : 38.6mm/1.52in

Overall Shaft Length : 41.7mm/1.64in

Bolt holes spacing : 16mm/19mm/0.63in/0.75in

Bolt thread : M3 \times 6

Connection : 3.5

Maximum thrust : 1100g

MOTOR THRUST VERIFICATION

Proposed Weight of Quadcopter = 1332.4 grams

Proposed weight of Payload = 495gram (1 Pint of Blood)

Total Weight of Quadcopter & Payload = 1827.4g (1.83kg)

Thrust Required to lift Quadcopter = 2:1 (Plus 20% percentage added to the higher number ratio)

Thrust = $1.83\text{Kg} \times 2 = 3.66\text{kg}$

Convert 3.66kg to grams = 3660g

$3660\text{g} + 732 \text{ (20\% of Quadcopter Weight)} = 4392\text{g. (4.39kg)}$

The Drone requires a Motor capable of generating thrust for a load of 4.392kg.

The Quadcopter has 4 Motors, The weight is divided among the 4 Motors.

Convert the Weight to Grams = $4.392\text{kg} \times 1000 = 4392\text{g}$

Divide the Weight among 4 Motors = $4392\text{g} / 4 = 1,098\text{g}$.

Each Motor has to generate thrust to carry a Load of 1098g.

Calculate the thrust required to carry a Load of 1098g

The unit for Mass is Kg and a thousand gram make one Kilogram.

Gravitational force Pulls down the Mass of an Object causing what is called weight.

On the Surface of the earth, the acceleration due to gravity is approximately 9.8m/s^2

The formula for Net Force ($f = ma$)

$$F = ma$$

$$\text{Mass} = 1098\text{g} (1.098\text{kg})$$

Applying the formula for Net Force

$$F = 1.098\text{kg} \times 9.8\text{m/s}^2 = 10.76\text{N}$$

F is Divided among the 4 Motors

$$\text{Motor} = 10.76 / 4 = 2.69 \text{ N}$$

Each Motor is required to generate a Thrust (Force in upper wards direction) of 2.69 N

All 4 motors will generate the required thrust to overcome gravity and lift the weight while the force is applied in the opposite direction to gravity.

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