

Engineering Specification Calculations

Speed

Rover must be able to move a minimum average speed of 1.25 ft/s since it needs to drive 30 ft. in 30 seconds while the RF transmitter may take up to 5 seconds to receive the code.

$$V_{ave} = 30\text{ft.}/25\text{s} = 1.2 \text{ ft/s}$$

Power

Drive system needs to deliver approximately 6.8 Watts of power to move the minimum average speed of 1.25 ft/s at a total weight of 4 lbs.

$$P = (f * d)/t$$

f = force

d = displacement

t = time

$$1 \text{ Watt} = 23.73 \text{ lb}\cdot\text{ft}^2/\text{s}^3$$

$$\text{Power} = (4\text{lbs} * 32.2\text{ft/s}^2 * 1.25 \text{ ft.})/ \text{s}$$

$$\text{Power} = 161 \text{ lb}\cdot\text{ft}^2/\text{s}^3 / 23.73 \text{ lb}\cdot\text{ft}^2/\text{s}^3$$

$$\text{Power} = 6.8 \text{ Watts}$$

Drift

Forward movement drift must be no greater than 0.5 ft. (left or right) for every 10 ft since it must drive forward 15-30 ft. and be in an area of $\pm 10\%$ of specified drive distance.

$$1.5 \text{ ft. (left or right)} / 15 \text{ ft. (forward)} = 1\text{ft.}/10\text{ft.}$$

*Allotted 0.5ft./10ft. to allow for over/under drive distance

Turn Accuracy

Turning mechanism on the tires must turn within $\pm 5^\circ$

$$\text{Accuracy} = \frac{\text{actual value} - (\text{actual value} - \text{measurement})}{\text{Actual value}} * 100\%$$

GPS Navigation

GPS module must point due north no greater than 20° left or right in 120 seconds.

If heading, x , is less than 180° :

Turn left $(x)^\circ$

If heading, x , is greater than 180° :

Turn right $(360 - x)^\circ$