Barn Door Tracker – RPM Calculation (using M6-1 bolt)

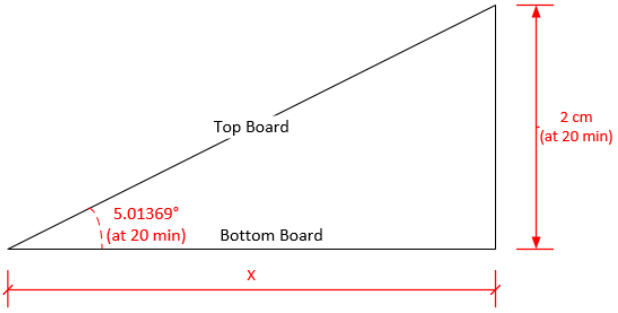
1) Earth's Rotation

The earth takes 23 hr., 56 min, 4.09053 seconds to rotate 1 revolution or 360 degrees. We will do our calculation for how fast the tracker must move in degrees per minute (dpm) so we will convert the dpm.

Earth DPM = 360 degrees / 23 hr., 56 min, 4.09053 sec
Earth DPM = 360 degrees / (23 hr. * 60 min/hr.) + (56 min) + (4.09053 sec * 1 min/60 sec)
Earth DPM = 360 degrees / 1,380 min + 56 min + 0.0681755 min
Earth DPM = 360 degrees / 1,436.069 min
Earth DPM = 0.25068 degrees/min

2) Barn Door Tracker as Right Triangle

Using trigonometry, we can approximate the barn door tracker as a right triangle with a base (bottom of tracker from the center of the hinge to the center of the drive bolt), the top board (hypotenuse), and the drive bolt at a right angle to base. We know that for a M6-1 bolt, it means that the bolt has 1 thread per mm. For ease of use, let's assume we want to calculate things based on moving the bolt about 1 revolution per minute. Therefore, we can setup our right triangle values we know (in red) with the angle α = 0.25068 degrees/min x 20 min = 5.01369°. We can set the opposite side as 2 cm (1 cm/10 rev. * 20 rev.).



3) Calculate Drive Bolt Location

Using trigonometry, we can calculate the distance from the hinge to our drive bolt using:
Tan(α) = Opposite/Adjacent
Adjacent * Tan(α) = Opposite
Adjacent = Opposite / Tan(α)
X = 2 cm / 0.087729
X = 23 cm (or 230 mm)

4) Therefore, if we place the M6-1 drive bolt at 230 mm from the center of the pivot hinge, we can rotate the bolt at 1 revolution per minute to match the Earth's rotation.

5) It is very important to understand this is an approximation. The right triangle is just an approximation for the angular movement of the Earth's rotation. As the triangle grows (longer we turn the bolt) the more it will be off. There is very little error for runs of 20 to 25 minutes.