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TUTORIALS

How To Build A Barn Door Tracker – A DIY Guide To Creating Your Own Simple Homemade Star Tracker



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11

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Think you need expensive gear to capture excellent night time images of the sky?
Or perhaps you feel you need complicated motor-driven equipment to shoot milky

way images?

Well guess again, today we're here to show you that it doesn't need to be expensive or complicated. For a few dollars in spare parts from the local hardware store and a few hours of your time, you'll be taking stunning photos in no time with a little help from this guide on how to build a barn door tracker.

Table Of Contents [[show](#)]

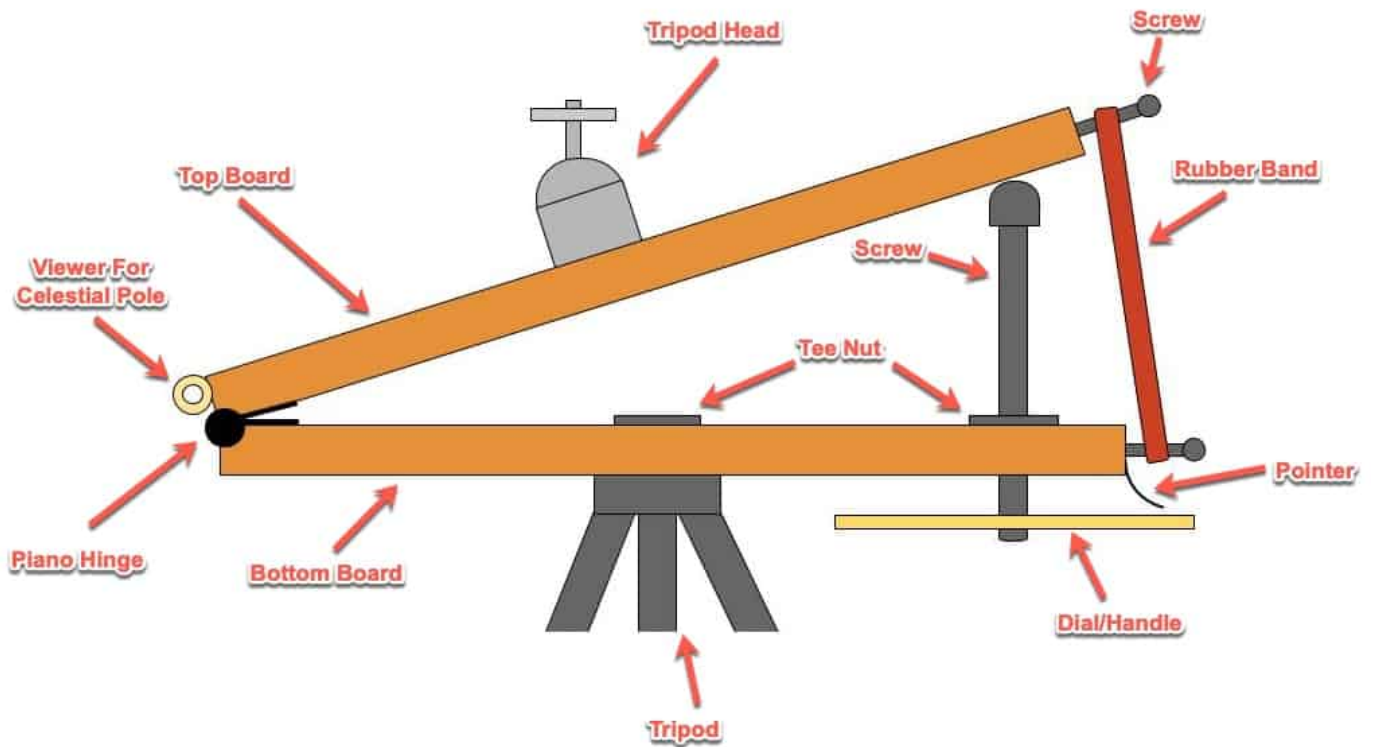
What Is A Barn Door Tracker?

A barn door tracker is a camera attachment (camera mount), used to capture long exposures of night sky images. It is a simple but effective way of eliminating the star trail effect of night sky photography without expensive equipment.

Because night photography requires much longer exposure times than daylight images, you run the risk of getting star trails in your images without it due to the [earth's rotation](#).

While you certainly can purchase a [commercial tracker for astrophotography](#) that automate this task, sometimes a project like this is just plain fun to build :). Especially when most of the parts you need are usually lying around the house or can be purchased cheaply from the local hardware store.





How It Works

A barn door tracker consists of two planks of wood, joined on one end with a movable hinge and at the other end an adjustable bolt that when rotated, elevates the top board higher.

This elevating action is what is required to help compensate for the earth's rotation effect on your images — allowing you to leave your camera to capture much longer exposures that you would typically be able to without one.





Types Of Barn Door Trackers

There are a few different variations of a barn door tracker (also known as a Scotch mount or Haig). While this article discusses building a simple single arm version, you can create some advanced versions that include electric motors and driver boards to control them.

Hinge Door Tracker

This is the type we are discussing in this article, nothing too complicated but extremely satisfying to build and portable to boot. With a leisurely afternoon, you'll be done and ready to capture those starry nights in no time.

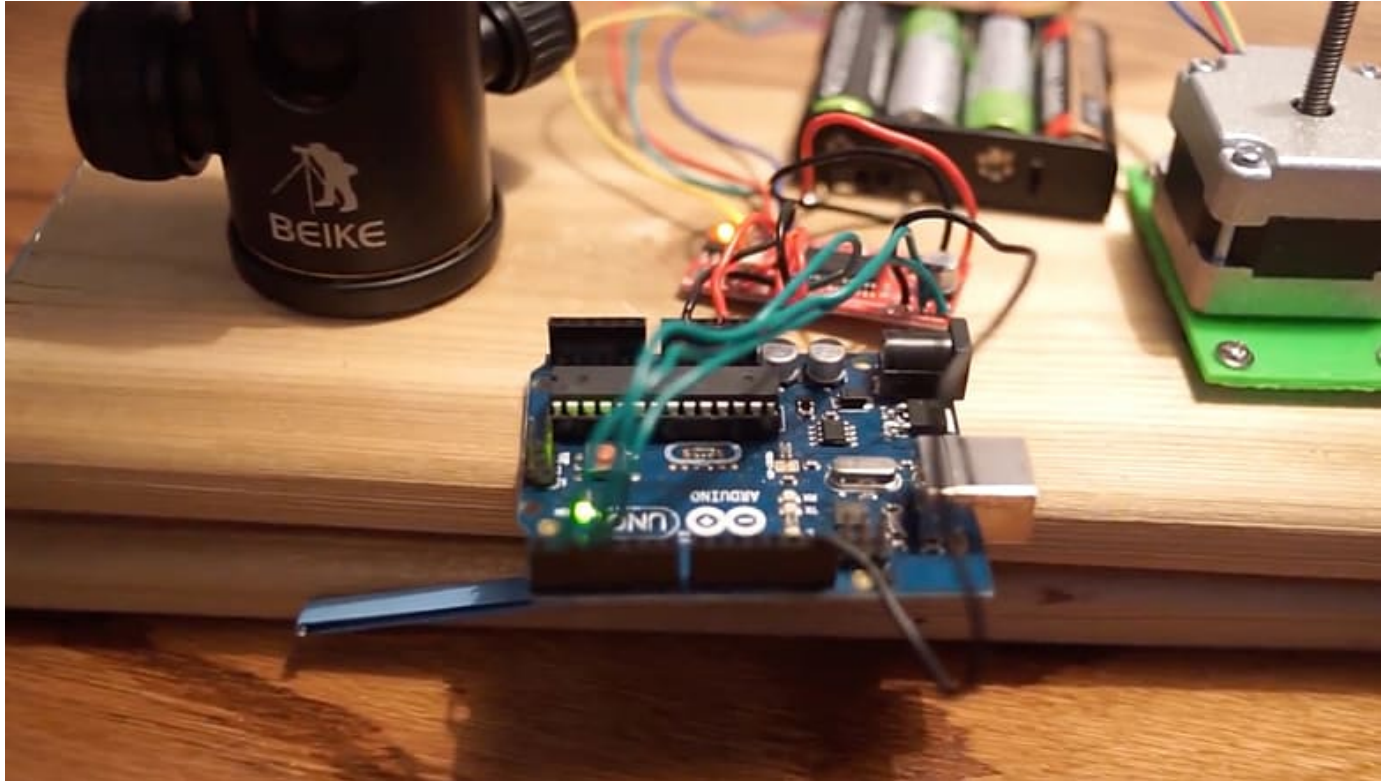
The below video shows an example of building a simple hinged version.

Electric Version (Motorized Hinge Tracker)

This up's the difficulty (but not too much), but when completed, it also gives it a hands-off, automated action to adjust to the earth's rotation. No need to manually adjust your dial.



This allows you to set up your camera, and then enjoy the impressive night sky while your camera and door tracker does its thing. While we'll probably discuss a motorized version in another article, these are some of the additional items you would be looking at for a motorized version.



What's Different To A Manual Version?

The main difference between the manual and electric versions when you DIY build a scotch mount is adding the electronic components. Using a threaded motor, this can be run with an Arduino Uno board (there quite cheap at around the \$20 mark) and all powered by a portable power or battery pack.

An electronic setup of what's needed looks like this

Prepare To Build A Homemade Barn Door Tracker

Tools Required

- Drill, Drill Index
- Protractor



- Black Magic Marker
- Pliers
- Hammer
- Screwdriver, Phillips Head
- File or Sandpaper
- Circular or Hand Saw

Parts Needed To Build A Hinged Door Tracker

Part	Size (Imperial)	Size (Metric)	Quantity
Wood	(4" or 6") x 13" x 5/4*	(101.6 cm) x (330 cm)	2
Tee nut, 1/4-20 internal thread	NA	NA	2
Lock washer & nut	1/4"-20		1 each
Circular wood for a handle. Should have a flat on it.	2 1/2" or 3" diameter	63.5 cm or 76 cm	1
Piano Hinge** (Match Board Width)	4" or 6"	NA	1
Carriage Bolt	1/4"-20, 6" long	NA	1



Part	Size (Imperial)	Size (Metric)	Quantity
Cap Nut	1/4"-20	NA	1
Round Wood (Obtain from a hobby store. Used for puppet heads.	2-3/4" diameter	~70 cm	1
Wood Spacer- about the size of the Round Wood	1-2" square		1
Hangar Bolt (get a shorter length if you can.)	1/4"-20 x 2"		1
Rubber Plumbing adapter, 2" to 1 1/2". Made by Fernco®, part number P22U-139	NA	NA	1
Wood	1-1/2" x 5" x 5/4" thick	38 cm x 127 cm x 32 cm thick	1
White Paint	NA	NA	not much
Construction Adhesive or Liquid Nails			1



Part	Size (Imperial)	Size (Metric)	Quantity
Optional: Bike Spoke or Plastic Straw			1

Work Out The Calculations

First I'd like to talk about what the actual problem is, if you want to take a picture of the stars you have to leave your shutter open long enough for the light to appear in the image. But too long and we start to get star trails because the earth is continuously spinning.

If you leave your shutter open for much more than around 15 seconds before the Stars have moved enough that you get trails. (Use the 500 rule to work out the maximum time before you get star trails).

While images of [streaking stars at night look amazing](#), what we're building here is designed to eliminate star trails so you can leave your shutter open longer to gather more light.

To begin to work this out, you first have to realize that you also have to rotate your camera to counteract the movement of the earth and because the [earth completes a full spin](#) once in 24 hours. That means we want to spin our barn door tracker at a rate of 360 degrees every 24 hours, which comes out to be 0.25 degrees per minute.

Assembly & Setting Up Your Door Tracker





1. Cut your two blocks of wood pieces into 13" x 4" pieces. You can, however, make a 6" wide board and use a 4" hinge but you may give up some stability. (If using a 4" hinge, cut the board to be 4" wide, if 6" hinge, cut to 6" wide)
2. Attach the piano hinge to the edge of the board with screws and screwdriver. Drill clearance holes by marking the holes. The hinges should face each other. [Click here for a picture.](#)
3. Bottom Board. CAREFULLY measure off 11.42 inches from the center of the hinge. This is the most critical part of the building process! Drill a hole just big enough to allow the insertion of the T-Nut. Insert the T-Nut from the top side of the board and pound in with a hammer. Drill another hole in the very center of the board for another T-nut. This will allow you to hook up the tripod to the tracker. Pound in the T-nut with a hammer.
4. Handle. Cut out handle to be a round piece of wood, approximately 2-3/4" in diameter. If this is a difficult task, there are several substitutes including a 12 sided handle. Drill a clearance hole in the middle to allow the carriage bolt to pass through. Paint the handle white. Use spray paint or any white house



paint. I just dipped mine into a paint can and let it dry by hanging it off of a vice.

5. Using the protractor, put tick marks on every thirty degrees along the top edge. Then mark one of those tick marks from the center of the wheel to the edge. Starting on that line, make a mark on the edge all the way down. Make the 30-degree increments from the top only halfway. Every ninety degrees make marks from top to bottom.
6. Camera Mount. Take wood spacer (from any scrap that you have) drill a hole in it to put the Hangar bolt into it and the Round Ball.
7. Top Board. Use construction adhesive and mount the Rubber Plumbing adapter on the somewhere over where the tripod will be or near where the carriage bolt will hit the board.
8. Insert the Carriage Bolt through the bottom of the handle and slide the Lock Washer on the opposite side of the carriage bolt head. Then thread on the nut and tighten until the head of the carriage bolt sinks completely into the wood.
9. Now insert the assemble wheel into the hole in the bottom board where the T-nut is. Thread it up till about 1/2" above the top surface of the board.
10. Now thread on the Cap Head onto the end of the bolt. This allows a nice rounded surface to engage the top board!

Some Upgrade Tips

Just wanted to mention a few quick adjustments and upgrades you can make to your barn door tracker that will make your life a little easier when you go out and put it to the test.

Attach A Small Rubber Band

This is a simple but useful upgrade. Use a small rubber band to keep the two boards (on the turning bolt side) sandwiched together. This helps to stop accidental movement from the top board as you adjust and turn the bolt during a photoshoot.



Just don't use a rubber band that is too strong or thick as it will cause too much resistance when you are turning the bolt.

Attaching A Viewfinder Or A Laser

Not a necessary option but makes your job much easier when trying to align your tracker to Polaris (polar aligned).

The most accurate and easiest way is to use a green laser as it doesn't require you to squint on the edge of your tracker through a makeshift viewfinder.

If you're trying to keep things on the cheap, then using an empty biro tube is a perfect macgyver tool :). Attach it to the end of your tracker, where the hinge connects the two planks of wood and use that as your viewfinder for polar alignment.

Polar Alignment



Your new tracker needs to be [polar aligned](#) to be of any use. What this means in simple terms is aligning your barn door tracker with either the north or southern

celestial pole (depending on what part of the hemisphere you live).

This is quite easy to do though, so no need to worry. If you're in the northern part of the hemisphere, then your job is a little easier. Simply find the pole star (Polaris) as it is easy to see with the naked eye visually.

If you're in the southern hemisphere, then there is no easy to reference star like there is in the northern hemisphere. The closest visible guide would be Sigma Octantis, which is about 1 degree in the distance.

If this all still sounds confusing, then this video explains it quite well also.

Using Your New Homemade Barn Door Tracker

You need to turn the handle one full rotation per minute to compensate and match the earth's rotation and keep your stars aligned.

Just because of the limitations of the design and lengths of the bolts we can use, a barn door tracker is only really capable of being used for approximately 8-10 minutes before you either run out of bolt length, or your tracker becomes too vertical, resulting in the camera becoming unbalanced.

How Often Do I Turn The Handle?

This varies a little depending on your lens focal length, below is a guide to how much the bolt/dial needs to be turned to keep your image at the same rotation as the earth. As you will see, the more of a zoom lens you use, the shorter the times are before each turn.

- **Wide Angle (35mm or less)** – 180 degrees turn every 30 seconds. At this length, this technique is effective for up to 15 minutes.
- **Normal (40-65mm)** – 90-degree turn for every 15 seconds. This keeps you in sync for about 10 minutes with the earth's rotation.



- **Telephoto (70mm or more)** – 30 degree turn every 5 seconds. Because of the closer zoom, this only stays effective for about 5 minutes.

Keep Track Of The Seconds

The success of using a barn door tracker comes down to consistently turning the bolt at set intervals. There are many ways to do this, but the easiest way is to use a timer that will beep at set intervals. So if you were using a wide-angle lens that was less than 30mm, you would set an audible timer to beep every 30 seconds.

Another way that has many seem to recommend is to use the second's hand on an analog watch. This makes it a little hard to see in the dark, which is why I prefer an audible signal.

Conclusion

Now you know how you can make your own star tracker for a few bucks rather than a commercial one that will cost a few hundred at least.

If anything, it's a fun project and quite an enjoyable afternoon tinkering away in the shed (at least it was for me 😊).

I hope this article helps show you that a lot can be achieved with a little creativity and some handy work.

So the next step is to put your newly created barn door tracker to good use, and remember, if you do capture something that you think is worthy, send it through as we'd love to see them and show them off to the rest of the readers. Happy building!



About Charles Wade

Charles is an avid photographer who took up astrophotography due to his fascination with space. He instantly fell in love with night sky images and has been continuously learning ever since.



On most clear nights you can find him in the backyard testing and tweaking, always trying to get that perfect shot.



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