

Star trail Photography Guide

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Star trail photography utilises long-exposure times to capture the apparent motion of stars in the night sky due to the rotation of the Earth. A star trail photograph shows individual stars as streaks across the image, with longer exposures resulting in longer streaks.

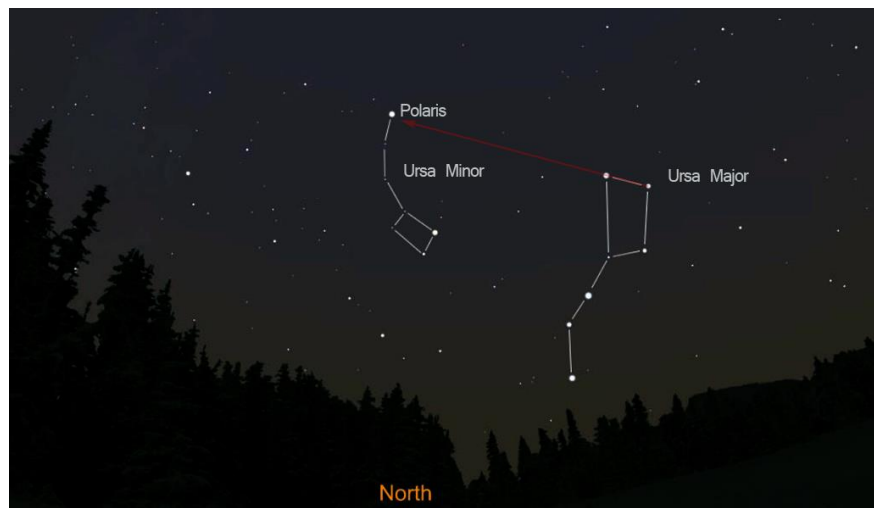
Star trail photographs is evidence of the rotation of the Earth on its axis. The motion of the earth is recorded as streaks of the stars. In the northern hemisphere, aiming the camera towards the north celestial pole creates an image with concentric circular streaks centred around the north celestial pole (very close to star Polaris). In the southern hemisphere, this same effect is achieved by aiming the camera towards the south celestial pole. Aiming the camera towards the east or west will create down-pointing lines streaks that are angled with respect to the horizon. The size of the angle depends on the photographer's latitude.

How to find the celestial pole

Wikipedia describes the celestial poles as “The north and south celestial poles are the two imaginary points in the sky where the Earth's axis of rotation, indefinitely extended, intersects the imaginary rotating sphere of stars called the celestial sphere. The north and south celestial poles appear permanently directly overhead to an observer at the Earth's North Pole and South Pole respectively. As the Earth spins on its axis, the two celestial poles remain fixed in the sky, and all other points appear to rotate around them, completing one circuit per day.”

The north celestial pole

For photographers in the northern hemisphere finding the north celestial pole is much simpler than finding the south celestial pole in the southern hemisphere. In the northern hemisphere there are currently a relative bright star called Polaris which is very close to the northern celestial pole. Polaris is at the end of the constellation Ursa Minor (Latin for "Smaller Bear"), also known as the Little Bear. Like the Great Bear, the tail of the Little Bear may also be seen as the handle of a spoon, hence the other name Little Dipper. It was one of the 48 constellations listed by the 2nd century astronomer Ptolemy, and remains one of the 88 modern constellations.



Note how an imaginary line connecting the two stars of Ursa Major points directly towards Polaris.

The south celestial pole

Photographers in the southern hemisphere are not so lucky to have a bright star indicating the south celestial pole. To find the south celestial pole you need to use more pointers and even then it will end up being guesswork.

To find the south celestial pole, we make use of two constellations, namely the Southern Cross and



the two brightest stars in the constellation Centaurus: Extend a line through the long axis of the Southern Cross (about 4.3 times the length of the long axis). At the same time, draw an imaginary line between the two bright stars of the Centaurus constellation (alpha and beta Centauri). From the middle of this line, draw a right angled line towards the extended line from the longest axis of the Southern Cross. You will find that these two lines will meet each other eventually. This point is close to the south

celestial pole.

Composing your star trail photo

The classic star trail photo normally consists of a landscape scene with some interests in the foreground and then the sky filled with circles around the celestial pole. It is therefore important to place the celestial pole somewhere in the sky to create a balance between the features in the foreground and the circles around the celestial pole. In the example on the right there is good balance between the bush in the foreground and the circles in the sky, with some added interest created by the small silhouetted bush on the horizon. I found that an ultra-wide angle lens works well for star trails, but not too wide. On a full frame sensor I will normally not go wider than 20 mm (14 mm on a APS-C size sensor). A wider field of view will result in distortion of the circles (the circles will take on the shape of an egg!)



Due South – 1 hour 40 minutes exposure

As mentioned in the introductory paragraph, one may also opt for a composition that will not show the star trails as circles, but rather curved lines. This is accomplished by setting your camera to point east or west. When composing the scene this way, I will normally go as wide as possible (even 12mm on a full frame sensor!) as this will give a much wider field of view and thus include the curves formed around the north as well as the south celestial poles.



Due East – 3 hour exposure

Setting up your camera

There are two basic techniques for photographing star trails when using a digital camera:

1. Taking one ultra-long exposure photograph.
2. Taking a series of photographs and combine them in post processing to create the star trail photo.

I will discuss both techniques as I am using both techniques based on the circumstances as well as the look I want to capture.

Technique 1: One ultra-long exposure

When to use this technique

- Only use this technique in a total dark environment – far from city lights and no interference of the moon.
- This technique also works well if you are worried that some clouds may move over your scene during the exposure.
- This technique will show some detail of the Milky Way if you include the Milky Way in your scene.
- In the southern hemisphere you will also be able to recognise the two irregular dwarf galaxies known as the Magellanic Clouds in your south pointing star trail photograph (if they are visible above the horizon).



Ancient ruin – 1 hour exposure

How to setup your camera

I normally use the following settings:

- An aperture of F8
- **Long exposure noise reduction** switch on
- ISO 200
- Bulb mode
- Cloud or shade white balance

Important to know

For this technique, you need to make use of a camera remote control or cable release and you need to lock it for the period of exposure.

When using the “long exposure noise reduction” setting on a digital camera, the camera will do the noise reduction processing after you stop the exposure. This process is exactly as long as the exposure time. For example, if you take a photo for 1 hour, the noise reduction processing will take another 1 hour. If you switch the camera off before this second hour is finished, or if your camera’s battery does not have enough power for a 2 hour exposure, it will ruin your star trail photo.



A balancing act – 1 hour exposure

Technique 2: Series of photos

When to use this technique

- When you plan to take a photo in semi-darkness such as when the moon is visible or where artificial light will have an influence on the exposure.
- If you do not have a remote cable release and your camera has a built-in interval timer function.
- When you want to take a star trail photo longer than a one hour exposure. Because you do not need the long exposure noise reduction to be switched on you will therefore get more exposure time from your camera’s battery.



Under the full moon – 2 hour exposure

How to setup your camera

Before using this technique, you need to determine how much ambient light there is, and based on the ambient light select an appropriate aperture and time value.

For the photo “Under the full moon” the following settings were used:

- ISO 200
- Aperture: F8
- 24 x 5 minute exposures.

Based on the high amount of ambient light at Rijk’s guest farm the following settings were used for the photo:

- ISO 200
- Aperture: F4
- 160 x 20 second exposures.

Important to know

The slowest shutter speed on most cameras is 30 seconds. To use longer exposures than 30 seconds, you will need an external camera remote with an interval timer option that allows for longer than 30 second exposures. I use a Hähnel Giga T Pro remote release for this purpose. If you do not own such a camera remote you need to use an exposure time of 30 seconds or less.

Follow these instructions for exposures of 30 seconds or less:



Rijk’s guest farm – Tulbach – 53 minute photo stack
Photographer: Guo Jing

- Set the camera on the appropriate shutter speed (in our example 20 seconds were used).
- Set the camera on continues shoot mode.
- Select the appropriate aperture (in our example F4 was used).
- Make sure log exposure noise reduction is switched off.
- Using your normal cable release, start the first exposure and then lock the release as if you were taking a photo in bulb mode.
- The camera will take the first photo at the selected speed, and directly after that it will take the next photo. This process will continue until you unlock the cable release button.

General settings to keep in mind

- Use manual focus to prevent the camera from trying to focus while busy capturing your star trail photo.
- Make sure the **long exposure noise reduction** setting is **off** when using the photo stacking technique.
- Close the viewfinder – stray light may enter through the viewfinder during a long exposure. If you do not have your viewfinder cap, use a piece of duct tape to seal the viewfinder.
- When taking photos using the stacking technique, ensure that the waiting time between exposures are not too long – I usually try to keep it at 3 seconds. (When using the continuous shooting technique as described in above, you do not need to worry about this)
- Select a specific white balance (not auto white balance) when using the photo stacking technique as the colour of the light may change over the period of an hour.
- For the photo stacking technique, take one or more dark frame photos at the end of your photo session. This is used during post processing to remove any digital noise generated by the camera sensor.
 - To take a dark frame photo, place the lens hood on the lens and take one or more photos with the same settings as all the other photos for your photo stack.
- To create an interesting foreground, use a normal torch and “paint” some detail in the foreground.
- Remember to wear warm cloths, you are going to be out in the cold of night for a very long time!



The quiver tree – 45 minute exposure

Post processing

When using the stacking technique, you need to combine all your photos using a software application.

I use an application called “Startrails”. This is a freeware application and you may download it from the following website: <http://startrails.de>



System requirements:

As it is developed in C# you need the Microsoft .NET framework installed. If you use Windows XP, Win 2000 or Windows 7 with automatic updates enabled the .NET framework should be installed. To download the latest framework use this Link

[Microsoft .NET Framework Version 4 Redistributable Package](#)

If you are interested in using Startrails you can download it here:

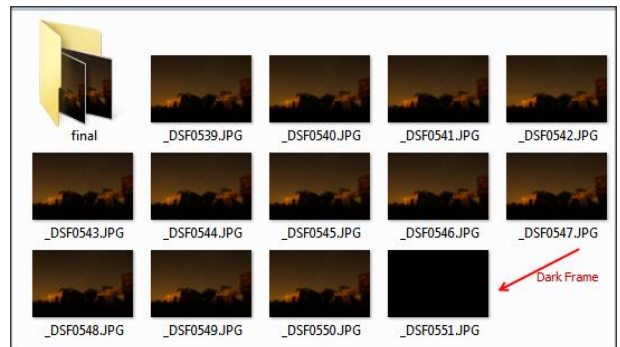
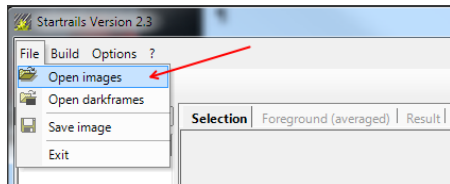
[Startrails.zip \(1MB\)](#)

Donations are kindly accepted and will help towards further development

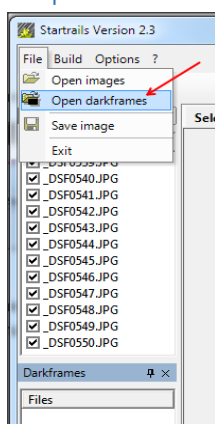
The software is downloaded in a Zip archive file. Unzip its contents to a folder. Double click the “startrails.exe” to open the application.

Step 1:

From the “File” menu, select “Open images” and add your set of star trail photos:



Step 2:



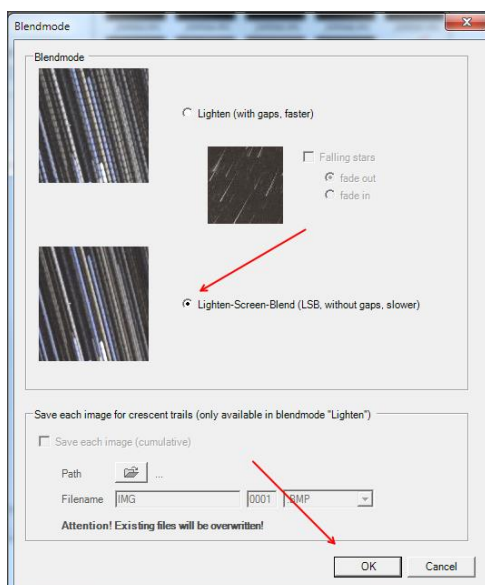
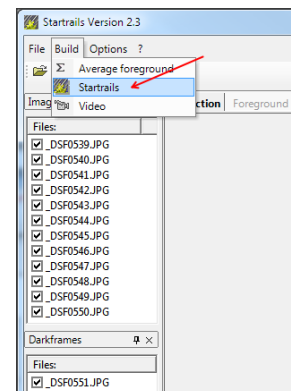
From the “File” menu, select “Open darkframes” and add the photos that you captured with the lens cap on the lens.

Step 3:

From the “Build” menu, select the “Startrails” menu option.

Step 4:

From the “Blendmode” dialog form select the “Lighten Screen Blend” option and then click on the “OK” button to start the building process.



The application will now build your star trail photo.

Step 5:

Once finished, save the star trail photo and do any other post processing in your normal photography workflow.

