ASIAir Controller

Contents

Overview

Overall, I am very happy with the ASIAir controller (I am currently using the 'Plus' version.) It is an excellent way to get started and overall, everything works pretty much as expected. As you get more experience you will start to notice some things that you would prefer to be different, and at that time you may be inclined to move on to other tools.

This document describes some of the things I encountered that were not immediately clear, or did not work quite the way I would have liked them to work.

Station Mode

The ASIAir can communicate with the ASIAir app (on whatever device you are using) in one of two ways:

1. Station Mode
2. Direct Mode (Station Mode OFF)

In **Station Mode**, both your ASIAir and app device will connect as peers to an existing WiFi network (presumably your home network.) They will use this network to communicate with each other. This method is much more convenient if you are working in your backyard because you don't have keep changing your app device WiFi network back and forth (assuming you use the app device, like your phone, for other things as well.)

Once in Station Mode, you can access the ASIAir installed flash drives by entering \\asiair in a Windows file explorer search field of a computer connected to the Station Mode WiFi network. You will then have direct network access to:

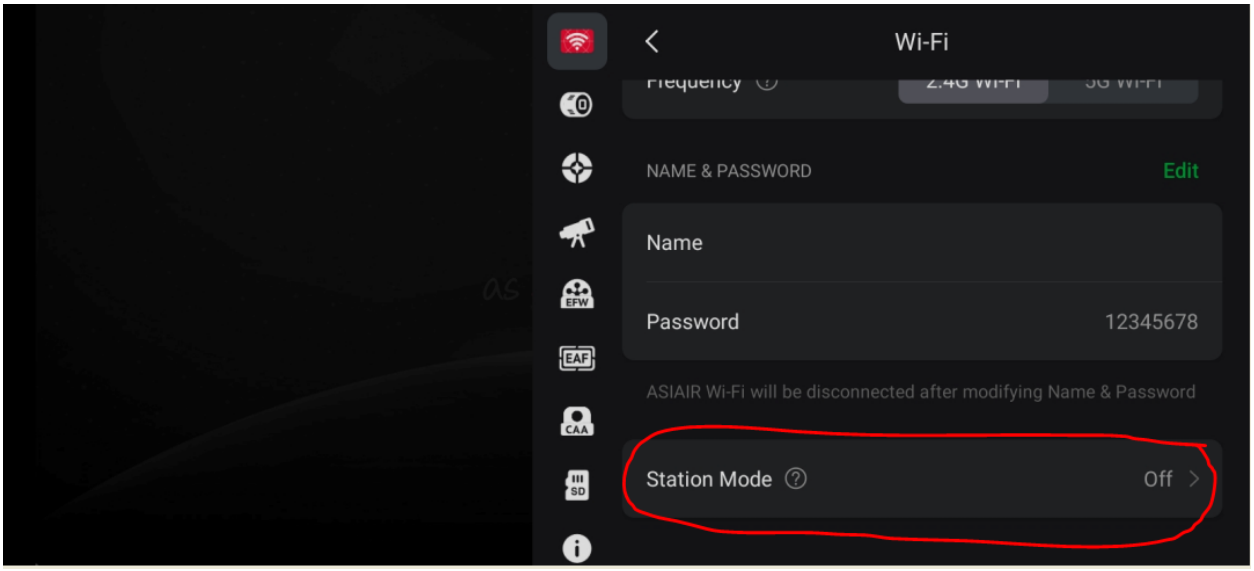
- EMMC Images (data stored on the limited ASIAir flash)
- TF Images (data stored on the optional Micro-SD flash drive)
- UDisk Images (data stored on the optional USB flash drive)

Using the Station Mode WiFi access is a **LOT** slower than carrying the flash drive back and forth, but it is MUCH more convenient if you are dealing with relatively small files (not large videos)! Large videos can take hours to transfer over WiFi.

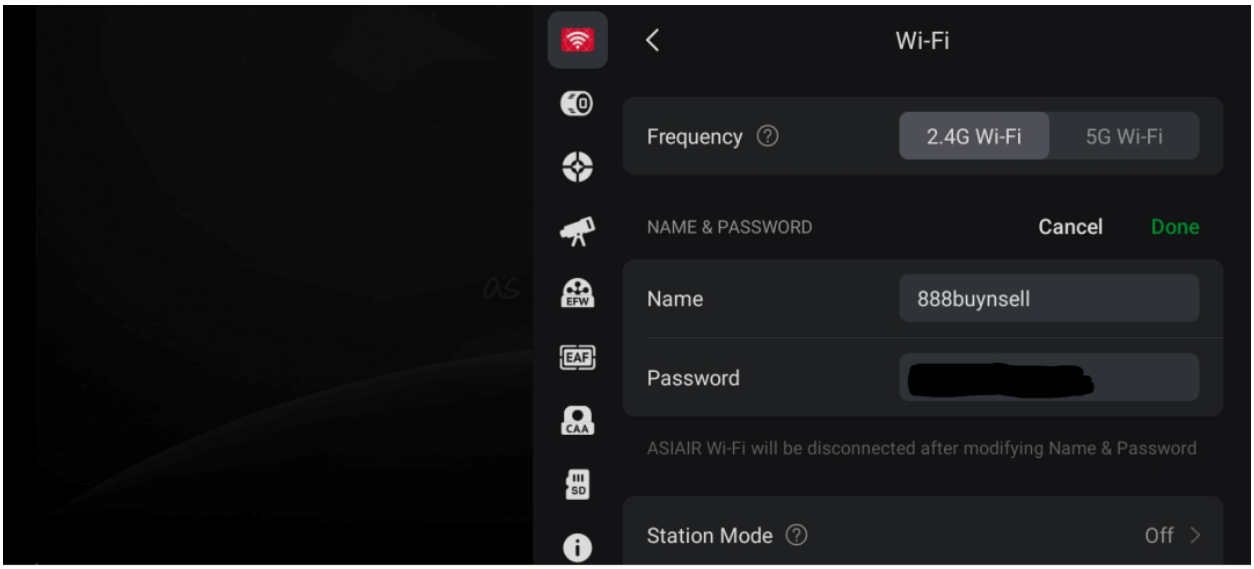
In **Direct Mode**, the ASIAir BECOMES a WiFi network provider. In this scenario your app device must disconnect from any other WiFi networks and connect directly to the ASIAir WiFi network. This is the ONLY mode available to you if you are out in the field and there are no other WiFi networks available to you. This is the mode that will be active when you initially configure your ASIAir.

Enable Station Mode

To enable station mode (this assumes that the ASIAir is currently in Direct Mode) you will first have change your app device to connect to the ASIAir provided WiFi network and connect using the default password of 12345678. Then navigate to the Wi-Fi section and select Station Mode.



Then enter your WiFi SSID and password, and turn on Station Mode.

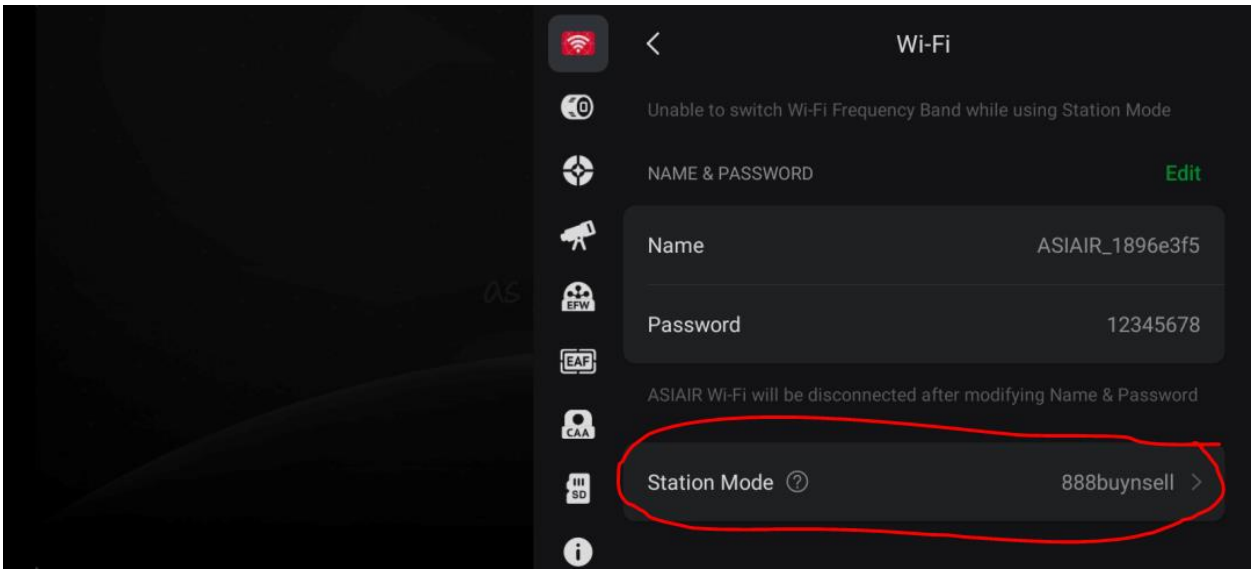


Your ASIAir should now be using Station Mode. However, now the ASIAir app will no longer be connected to the ASIAir device – because the WiFi has been changed – so you will need to exit the ASIAir app.

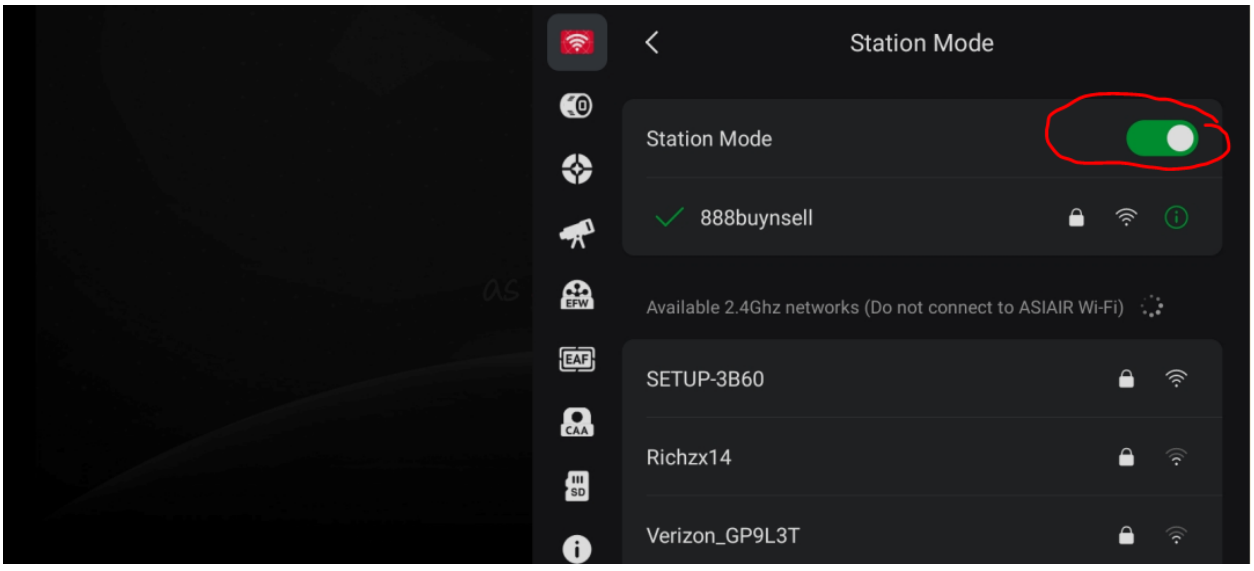
You must now re-configure your app device to also connect to the same WiFi network so that the two devices can communicate with each other. You can now re-start the ASIAir app and connect.

Switch Back to Direct Mode

To return to Direct Mode you should make sure your app device is connected to the Station Mode WiFi network and follow these steps.



Turn off Station Mode.



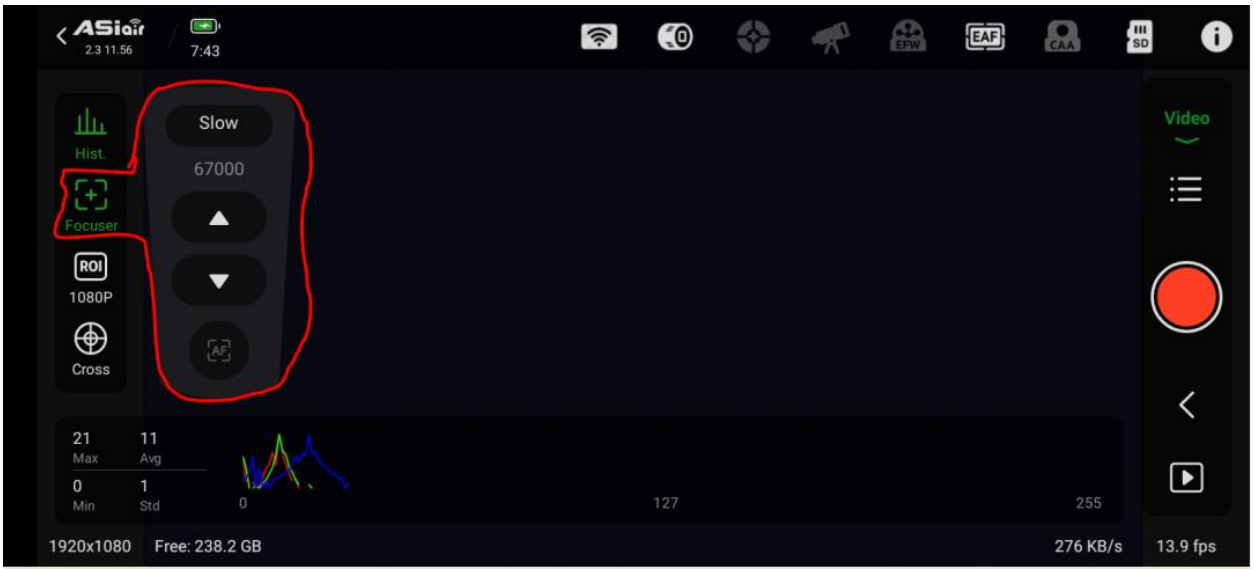
Your ASIAir should now be using Direct Mode. However, now the ASIAir app will no longer be connected to the ASIAir device – because the WiFi has been changed – so you will need to exit the ASIAir app.

You must now re-configure your app device to connect to the ASIAir WiFi network so that the two devices can communicate with each other. You can now re-start the ASIAir app and connect.

Shortcomings

Focusing Exhibits Huge Lag Delays

Several of the ASIAir feature screens have a 'Focuser' button that allows you to adjust the EAF focus while the feature is running – see below for the 'Video' feature screen example.



However, this button is almost useless (at least in Station Mode – I haven't tried it in Direct Mode) because of the huge lag delay (often around 30 seconds) between you pressing the 'up' or 'down' buttons and the focus actually changing while the video is running.

The reason for this, as best I can guess, is that the tools are using a single channel FIFO communication pipeline over WiFi so everything is being queued, and the large video frames are taking most of the network bandwidth.

For this reason, I would recommend that you purchase the EAF Hand Controller which allows you to control the EAF position without any app or WiFi delays.

The alternative is do your focusing in the 'Preview' mode where there is no active WiFi traffic and things work as expected. However, this is painfully slow because you have to move the focus, take a picture, wait for it to upload, and repeat until the focus looks good.

Video Frame Rate Limited

Because the ASIAir is based upon an average speed Raspberry Pi processor it is not fast enough to keep up with some of the faster video frame rates supported by cameras like the ASI585 which boasts a 47fps rate at full resolution. In my experience, I was only able to get maybe ¼ of this frame rate when using an ASIAir Plus.

Other users have noticed the same thing, and have switched to using faster laptops running other software tools to get better video performance.

Antenna Orientation

As can be seen below the antenna rotates. At first this seems nice, until you realize that for the WiFi to work properly at full strength the antenna MUST be pointing either directly up or down relative to the ground.

If your ASIAir ends up being mounted on your telescope (which is very common to facilitate the cabling) it will move around as you move from target to target, or simply track a targets movement over time. When this happens, it is important that you remember to manually re-orient the antenna so that it is pointing either up or down. If you fail to do this you may encounter cases where the ASIAir drops off the WiFi network and loses communication with the app.

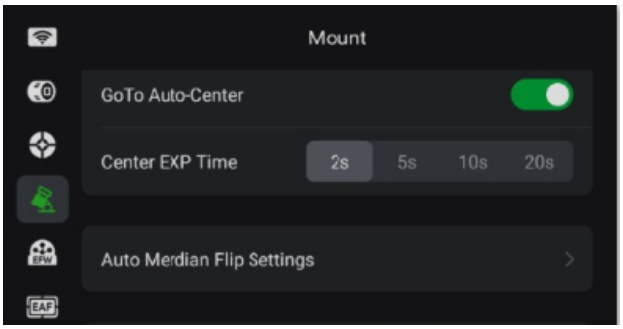
GoTo Centering Fails on Bright Planets

The GoTo feature has two components: moving the mount, and then centering the target.

Moving the mount is purely a math calculation and motor movement issue – it does not rely on being able to see the sky.

Centering the image is basically a plate solve to determine exactly where the 'Moving' portion left the telescope pointing. It then makes minor adjustments until the target is properly centered in the camera frame. Therefore, the centering needs to have a clean, in focus, view of the sky to work properly.

ISSUE: for some reason, the mount centering exposure time has its own separate setting, and does NOT use the exposure value you previously setup in the Preview feature. To make matters worse, the available centering exposure times are limited to: 2, 5, 10, 20 seconds!



So, if you are trying to center on a bright object, like Jupiter, the image will be washed out at 2s even at a camera gain of 0 – see image below left. The image below right is Jupiter at 1mS Gain 100.

What happens then is that, after the mount has moved to point to Jupiter, it tries to center, but constantly fails with an error message like: "385 stars detected" … "unable to center" … "retrying." The only way to get this to stop is to turn off the "GoTo Auto-Center" option (see above) Mount setting – however this leaves your target not quite in the center of the camera.

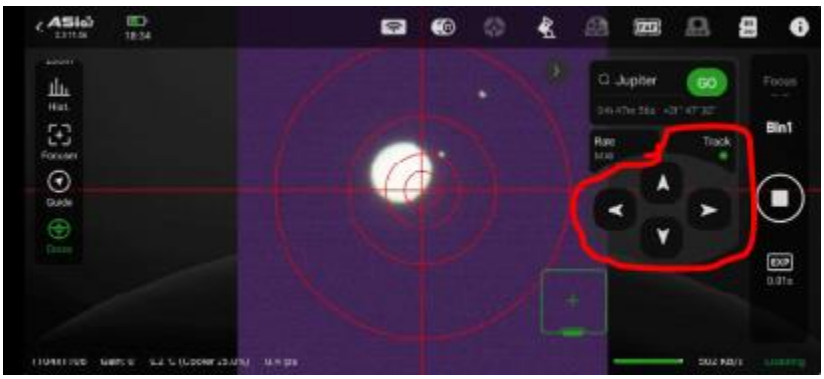
This seems like incredibly poor design to me – however I may be missing something.

I finally found what appears to be an explanation of this problem on the following ZWO Website.

> NOW you can tell it to Go To your desired target. Remember - it has to be in the visible sky (you can double check this using Stellarium or Telescopius). ***Also remember that it can't plate solve a planet or the Moon***. So, it'll send you to the spot it believes the planet is and plate solving may not succeed. Thats fine - stop the plate solving. Go into Video Mode and see if you can see the planet (adjust exposure, resolution, etc. and - if needed - focus).

Mount Controls Don't Work While Tracking is Active

If you are trying to adjust the center of a target (perhaps because of the Centering Issue) you will find that the app mount adjustment controls don't work as long as tracking is enabled. In a proper UI they would be greyed out when disabled, but here they just don't move the mount.



If, however, you turn tracking off the target (as expected) immediately starts to drift off the screen.

This problem is present in many of the app features. The only place where these controls seem to work is in the Video feature.

The only other way to adjust the mount, is to use the mount hand controller. The hand controller only has two speeds: fast and slow, and neither of these seem to be configurable so it is very difficult to accurately center the target using the hand controller.

EAF Hand Controller

The ZWO EAF Hand Controller is available for about $40 and plugs directly into the EAF allowing direct control over the EAF positioning (without any app/WiFi/queuing delays.)

The benefit if this is that it works almost like the original focus knob allowing you to easily adjust the focus up or down in a more natural way then repeatedly tapping the app touch screen buttons.

The only 'quirk' of using this is that the EAF position (as shown on the app screens) does not automatically adjust up/down as you move the focus position with the hand controller. In order to get the app EAF position to update you need to enter and then exit the EAF tab. After you exit the tab, then your base screen EAF position will be updated to correctly reflect the current value.

I find focusing with the hand controller MUCH easier and highly recommend it.

Things that are NOT obvious

Here are some of my notes about things that were not immediately obvious about using the ASIAIR.

- Storage & Access
  - The unit comes with about 20GB of available flash to store images
    - You can add either a USB flash drive OR a Micro-SD flash card for more memory.
    - If you add optional flash drives make sure to select which one you want to use before you start taking pictures or it will default to the EMMC.
- Videos
  - Don't assume your video will be recorded in color because you are using a color camera. If your exposure and gain are set too low, it will default to black and white video.
- Live mode
  - does stacking for you (and can optionally save the individual frames for you so you can also stack with an external program)
- Plan mode (Mosaic & Rotate features not available offline)
  - requires you to stack with an external program
  - is the only way to setup and shoot Mosaics
    - DON'T adjust your camera rotation AFTER setting up Mosaics in Plan or they will come out all screwed up.
  - allows you to shoot multiple objects automatically
    - but you may have to rotate and crop the results if the camera rotation isn't good for all the objects since it can't be changed in the plan.
    - this last point is why you want higher resolution on your camera so you can crop and not lose valid data.
    - In general, you are better off creating a different 'plan' for each of your targets rather than trying to do them all in one plan – especially if you need to rotate the camera between targets.
  - Forces a star alignment when capturing 'Light', but **NOT** 'Bias', 'Dark', or 'Flat'
    - So, if you are trying to run a "test" during the day, don't try to capture it in 'Light' or you will be stuck forever trying to get star alignment.
  - can also shoot your calibration frames.
    - They should be first in sequence so you can let it run unattended afterwards.
    - However, since Plan mode can't stack it's probably easier to do them with Live mode manually before starting your plan or after your plan completes.
  - This also may explain why Plan doesn't stack, because the calibration frames may not be available during the Plan run (if you shoot them at the end of the Plan), and certainly are not available during the Plan setup phase (if you shoot them in the Plan or after the Plan completes) so how could you specify them in the plan?
  - Every image is saved as BOTH a 'fits' and 'jpg' file. In postprocessing, the 'jpg' files are an annoyance and you need to delete them. There does not seem to be any way of getting ASIAIR to stop producing them.
  - I'm not sure if Plan mode allows you to specify "Area Of Interest" in the plan? On cameras that support it, this would be beneficial.

Workflows

Focus

The ASIAir has excellent focus and auto-focus logic when you need to focus on a star. Auto-focus does a great job, but is not a magic wand – you still have to follow certain steps.

If you have already focused on the stars (and not moved the focus setting) you can skip the Manual Focus steps and go directly to Auto-Focus.

Manual Focus (Getting it Close)

An alternative to the following steps, if you have a visual setup that matches your camera focus, is to simply look through the eyepiece and adjust the focuser knob until the stars 'look' good.

The following example screens show focus being achieved on the radio towers behind my house. First with just a camera, and second with the addition of a Barlow lens. This process is the same for stars.

Step 1 – Manually point the telescope at the north star (for non-terrestrial targets)

The assumption here is that if you need to focus, then you have not performed the polar alignment yet, and therefore the mount is unable to track celestial objects. Therefore, the only part of the sky that isn't moving very much is around the north star.

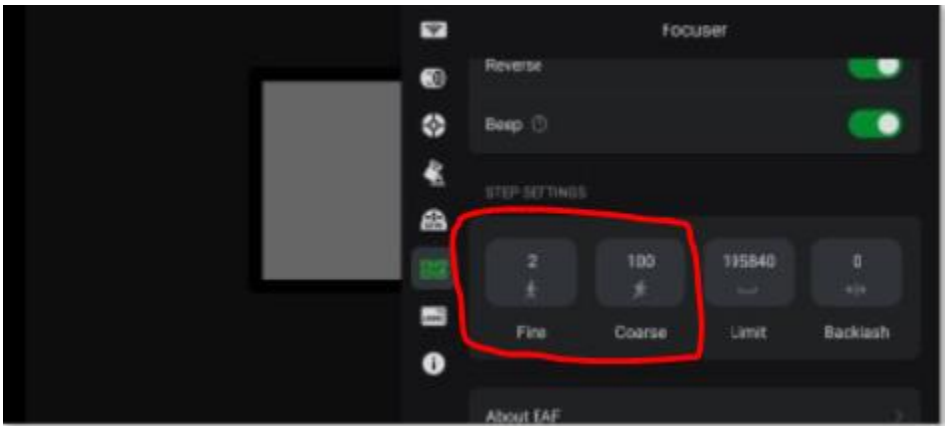
Step 2 – Go to 'Focus' mode and set the initial exposure time and camera gain

Good starting values are:

- Stars
  - 2 seconds and the 'M' (medium) camera gain setting.
- Terrestrial Objects during the day
  - 0.1 seconds and the 'L' (low) camera gain setting.

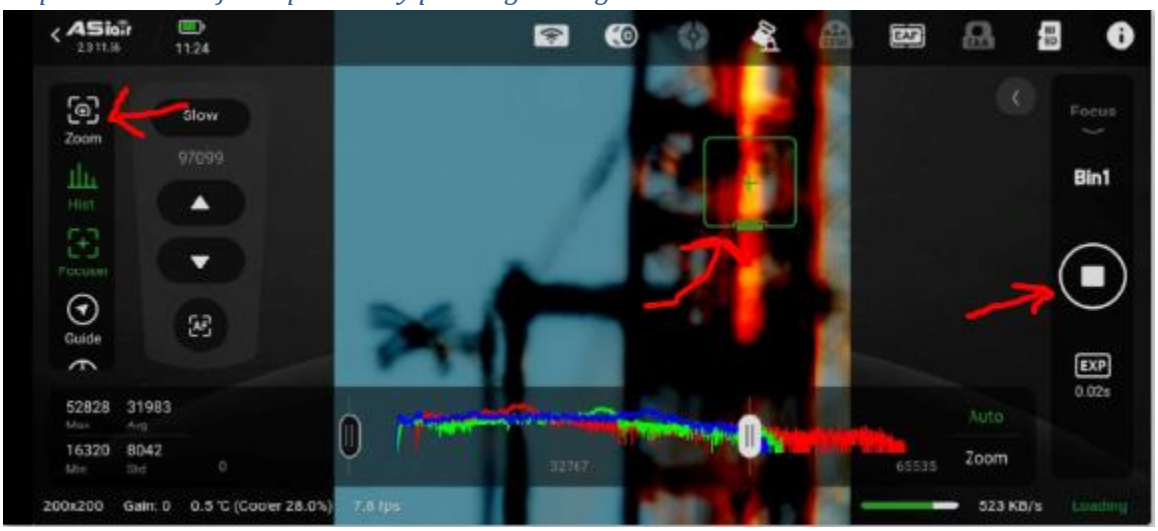
If there are any clouds, or you didn't wait long enough for the sun to go fully down, you may have to increase the exposure time and/or camera gain settings until stars become visible.

Step 3 – set your EAF focus steps



You may have to do this several times. When you are way out of focus, your Fine/Coarse settings will need to start with large numbers such as 200/1000 (which approximates the accuracy of turning the focus knob with your hand.) As you get the object more in focus you will want to use smaller numbers like 20/100

Step 4 – Start the focus process by pressing the big white circle button

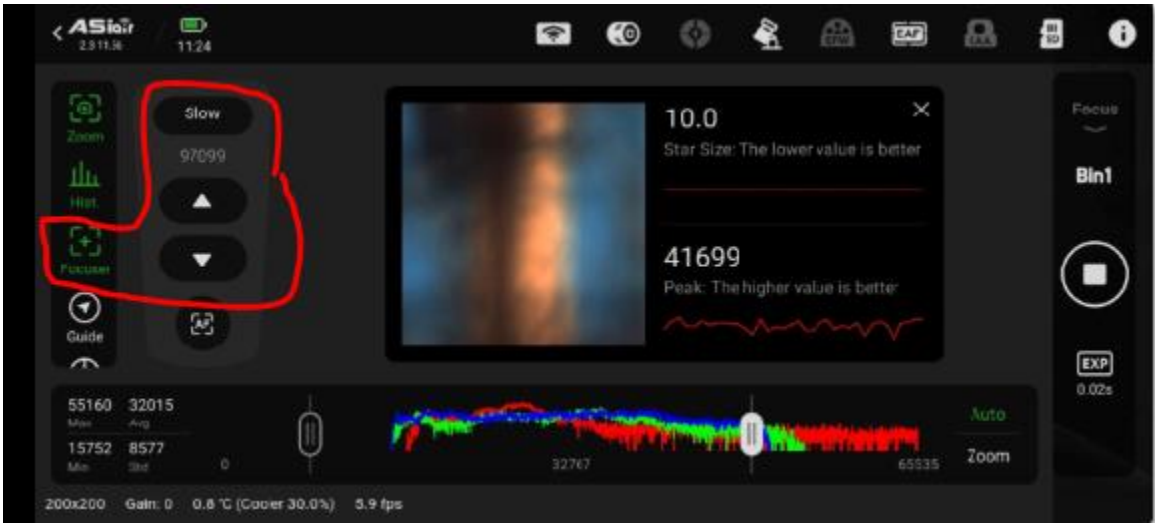


Drag the green rectangle onto your focus target (typically a star), and then press the 'Zoom' button.

The display will change (see below) to show a zoomed in version of your target, as well as its 'Star Size' and 'Peak' values.

Step 5 –Focus

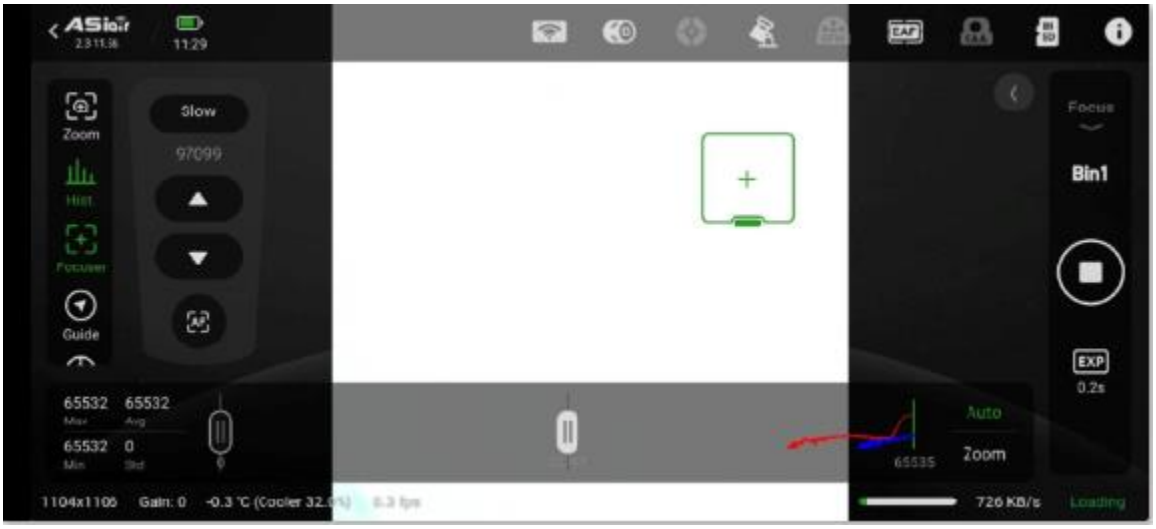
You can then use the 'Focuser' feature (or even better use the EAF Hand Controller) to move the focus up/down until the star looks reasonably good in the white area. You should also use the 'Star Size' and 'Peak' values to determine when the focus is good.



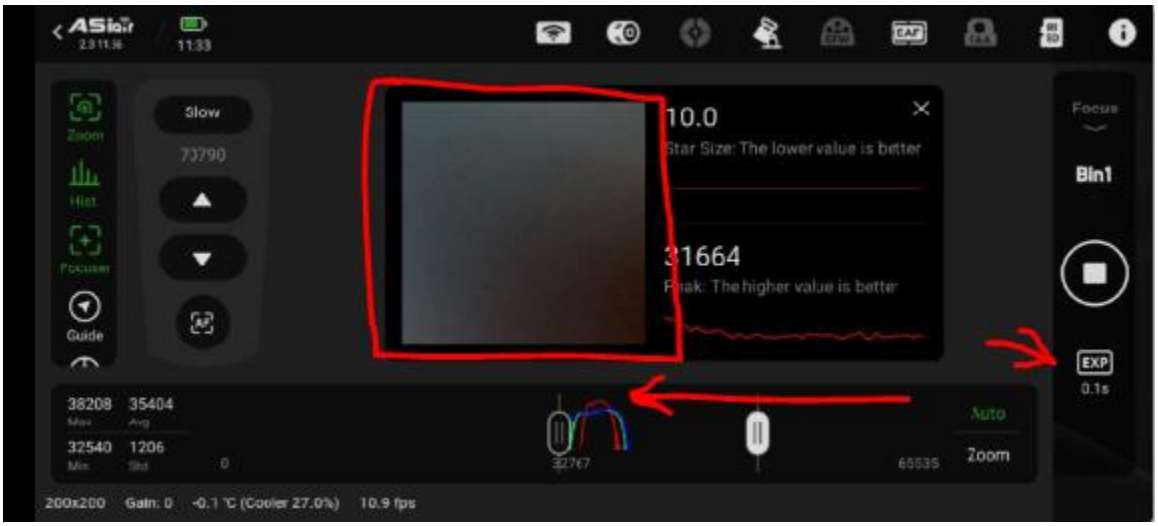
Swapping in a Barlow Lens – Initial Setup on a Terrestrial Target

Once you have basic focus on your target, you may want to insert a Barlow lens (ADC, etc.) into your visual train. This example continues on from the setup in the previous section (Manual Focus) to show how to re-focus with a Barlow added – for example swapping out the bottom right section for the top right section between your telescope and camera.

Once the Barlow (and ADC in this case) has been added the camera will show something like the image below of a washed out, out of focus image.



Even though you are still pointing at the same target (radio tower) the Barlow has completely altered the light path and you need to re-adjust everything. The first thing to note is that Histogram which is now showing a signal clipped on the right side indicating that the image is over-exposed.



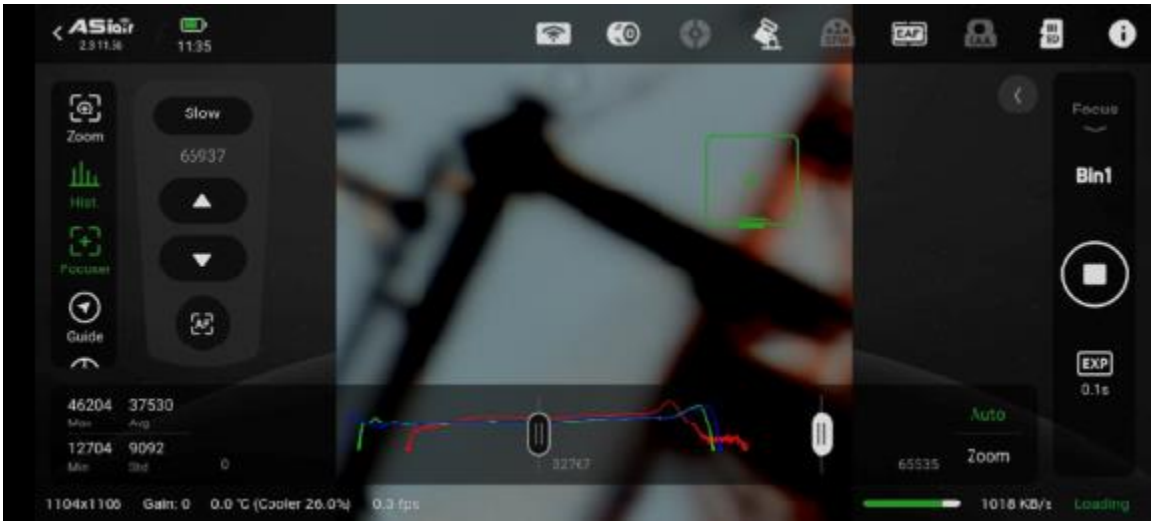
By adjusting the exposure time down (from 0.2 seconds -> 0.1 second) you can see that the Histogram has moved more to the middle of the range and the image is no longer washed out – although is still seriously out of focus.

Now you need to adjust the focus (see Previous Step.) If you are adding a Barlow, you will need to adjust the value ‘down’. As can be seen below, where the focus was changed down from 73,790 -> 67,825, the Histogram is starting to spread out and the image is starting to come into slightly better focus.

67,825->66,937

At a certain point, adjusting the focus down further will make things worse. This should be obvious on the image, and on the Histogram starting to contract again.

At this point, you have got your focus and can exit the Zoom mode to see your full target view and make any final adjustments you may need.



Swapping in a Barlow Lens – Planetary Observation

Once you have basic focus on your target, you may want to insert a Barlow lens (ADC, etc.) into your visual train. This example continues on from the setup in the previous section (Manual Focus) to show how to re-focus with a Barlow added – for example swapping out the bottom right section for the top right section between your telescope and camera.

Complete Polar Alignment and move the mount (if not already done) to the target – Jupiter in this example.

Preview to see if roughly centered or not.

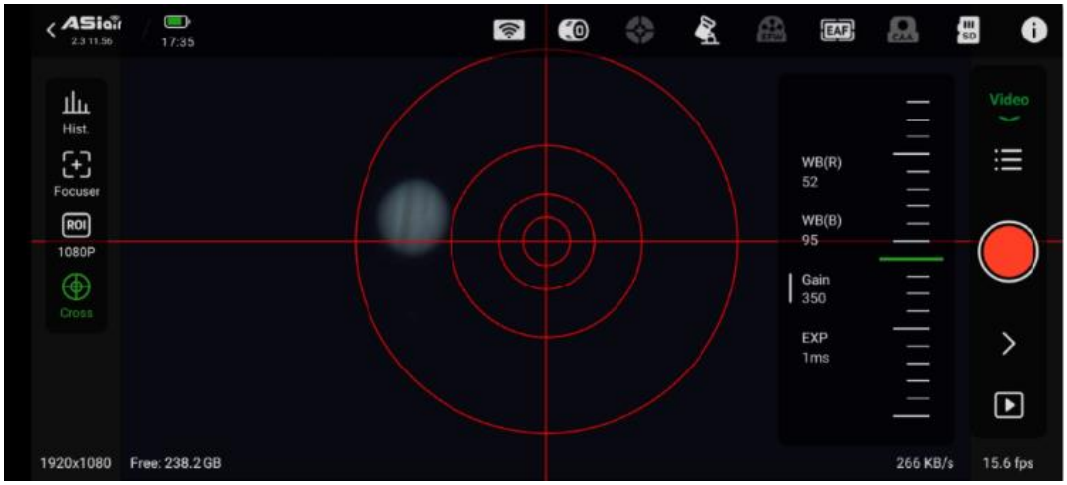
As can be seen Jupiter is a little to the left of the center, so you can probably just go to Video mode. If Jupiter were way off center, you would need to get it in the center first by using the mount movement arrow keys. Typically, the mount movement arrow keys will have the following effect on the target:

Move Target **LEFT**

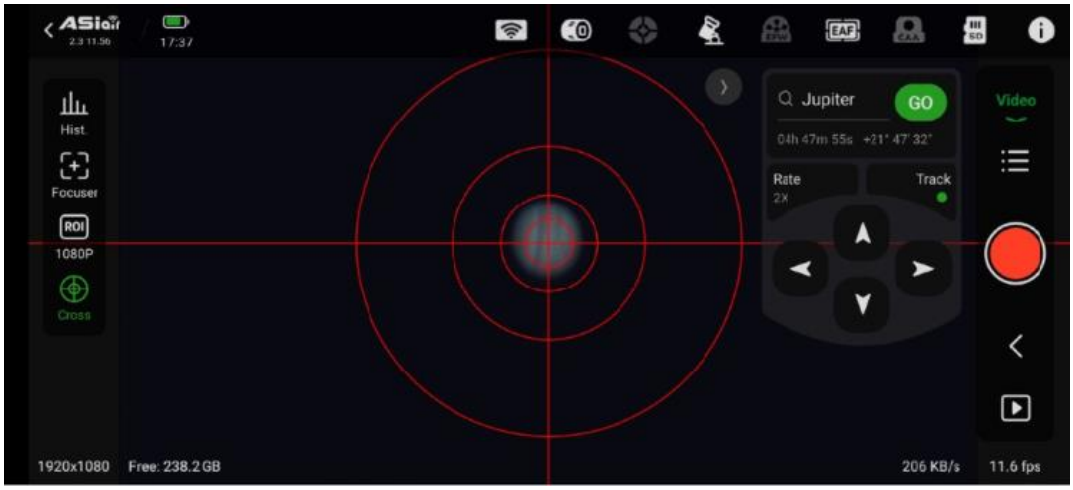
Move Target **DOWN** < > Move Target **UP**

Move Target **RIGHT**

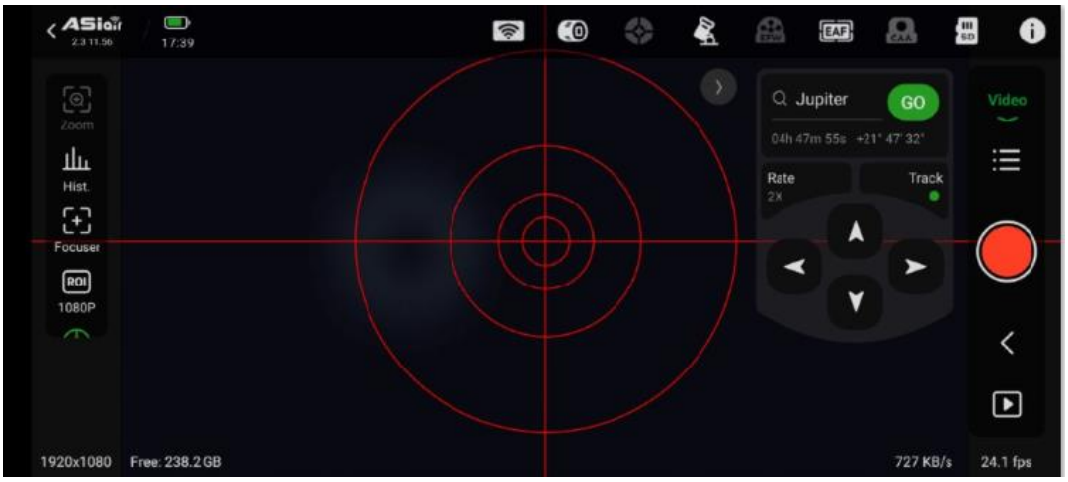
Switch to Video mode so you can use crosshairs – adjust gain & exposure

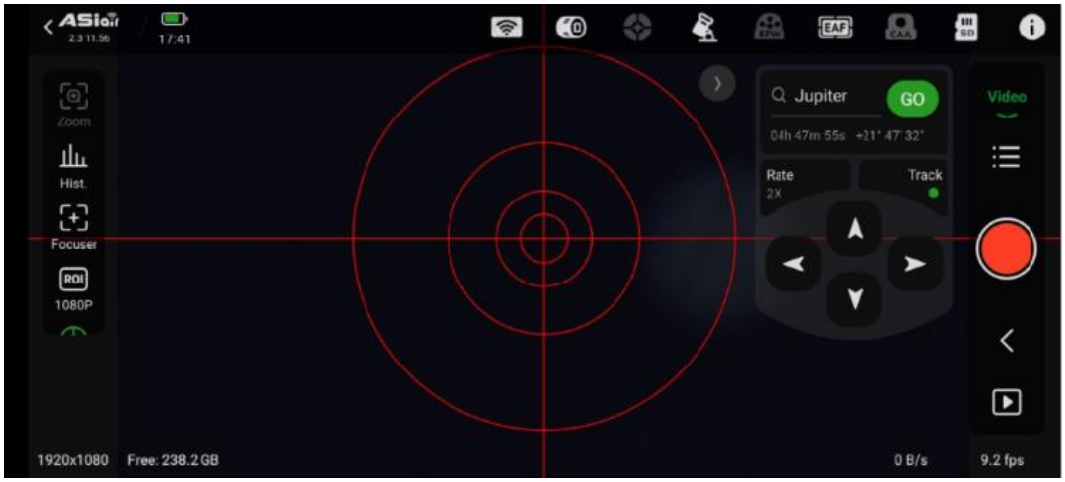


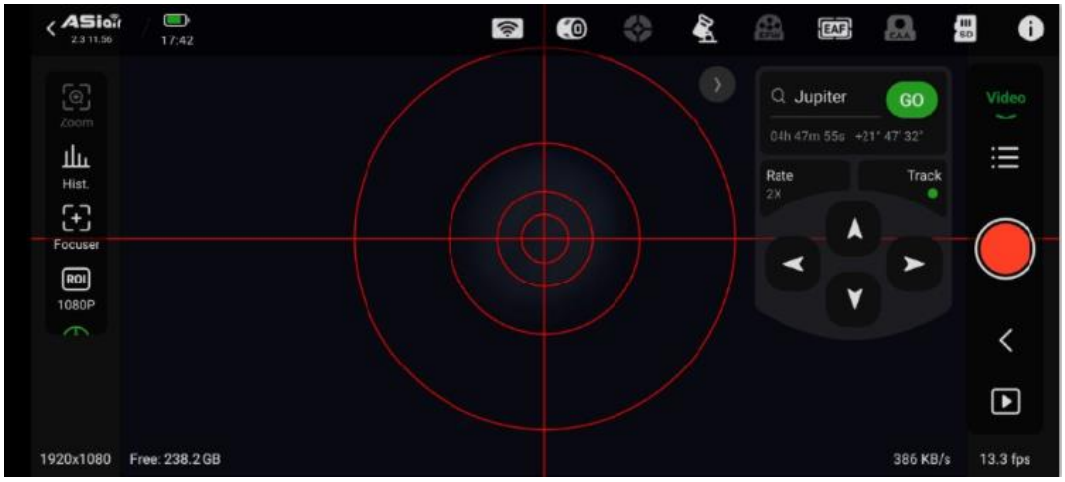
Using the mount adjustment arrow buttons, move the mount so Jupiter is in the center.



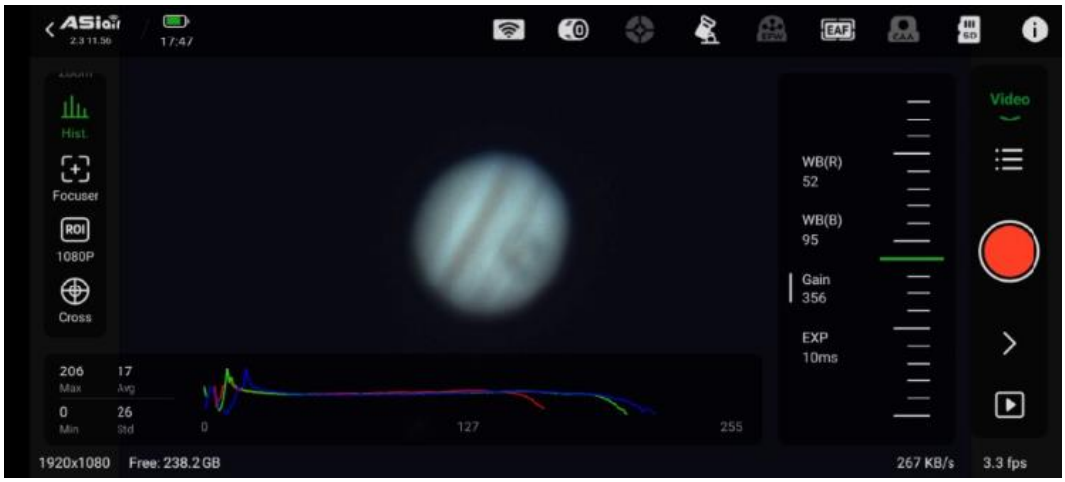
Now start the EAF to move to the Barlow focus point of 67000 (or wherever you previously determined the Barlow rough focus to be.) As it slowly moves Jupiter will get out of focus and start to move around out of the cross-hair center – this is because the mirror is moving of course. Be alert and use the mount movement arrow keys in 2x rate to keep the ever blurrier circle roughly in the center.



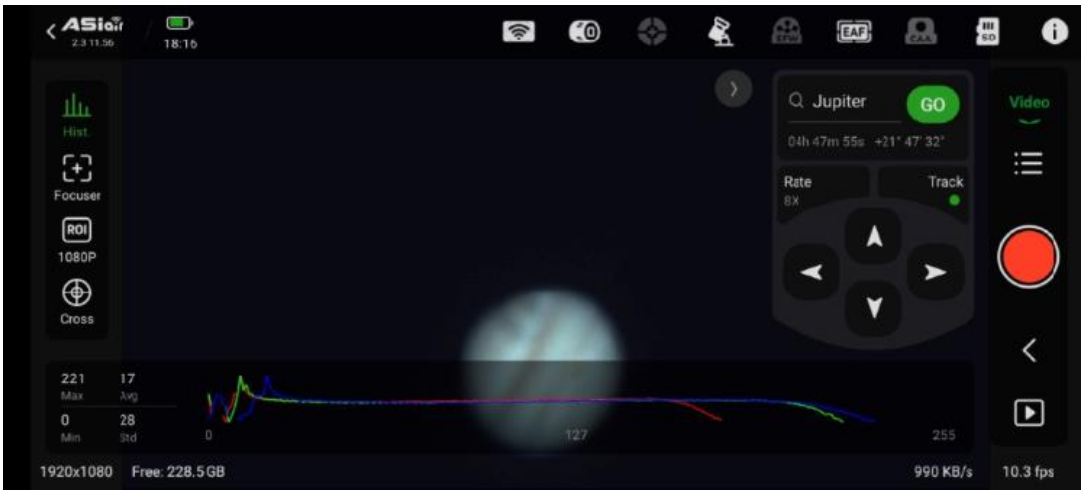




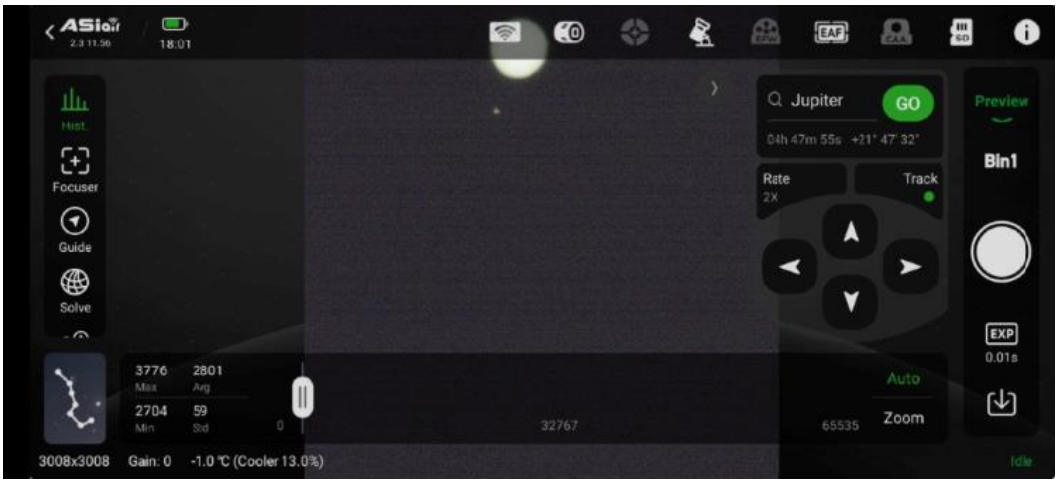
Once the EAF has reached the Barlow focus point, remove the empty tube and replace it with the Barlow assembly. You will now have to readjust the gain and exposure (move them up) so that Jupiter once again looks right.



You can move the mount around using the mount movement arrow keys. For example, to move it away from the black circle anomaly caused by the scope front mirror not being fully temperature adjusted.



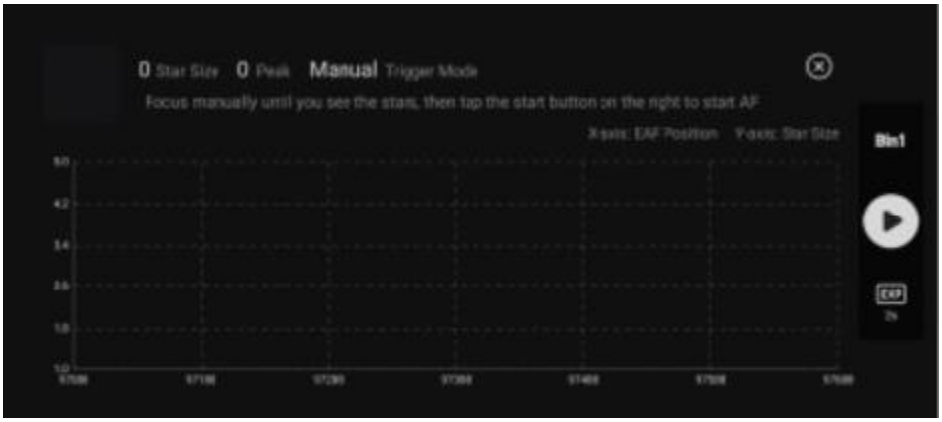
If you screw up and Jupiter flies off the screen, you will need to go to the Preview feature to, hopefully (if you haven't moved it too far off screen), see where it went and move it back to be roughly in the center again.



Once back in the center, you can switch back to Video mode and see it again.

Auto Focus (Stars & Planets ONLY)

Now that you have the focus “pretty good” you can use the ‘[AF]’ button to auto focus.



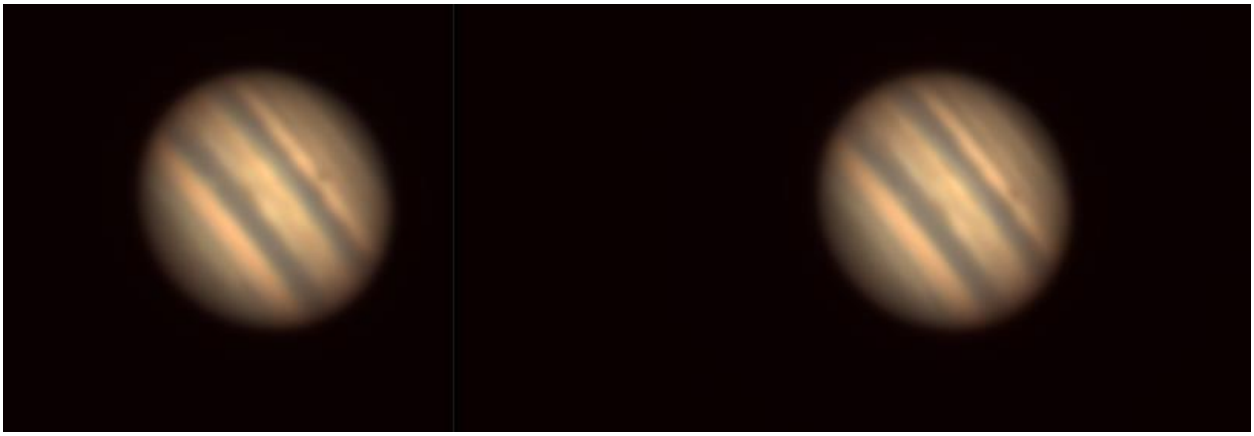
Press the big ‘>’ play button and the auto focus will adjust the focus up and down until the focus is exact as possible.

Planets

Surprisingly, the ASIAir focus system treats bright planets just like it would a large star so you can use the procedure outlined in Manual Focus to get accurate focus on bright planets.

I had previously been using the Video Focus work flow for planets – which is incredibly tedious and relies on your subjectivity in choosing good focus – before I realized this fact. For Jupiter, my best guess for focus was 97,565. However, when I ran auto focus on Jupiter, it came up with a more exact focus of 97,608. This is only a difference of 43 steps but it makes a difference.

Below are the 97,565 focus (left) and 97,608 focus (right) AS!4 stacked un-retouched images.



Below are the 97,565 focus (left) and 97,608 focus (right) processed in PixInsight using only UnsharpMask.

Even at a glance you can see that there is much more detail in the right image and these were taken on the same night only 20 minutes apart with identical camera settings.

Focusing in Video Mode (DEPRECIATED)

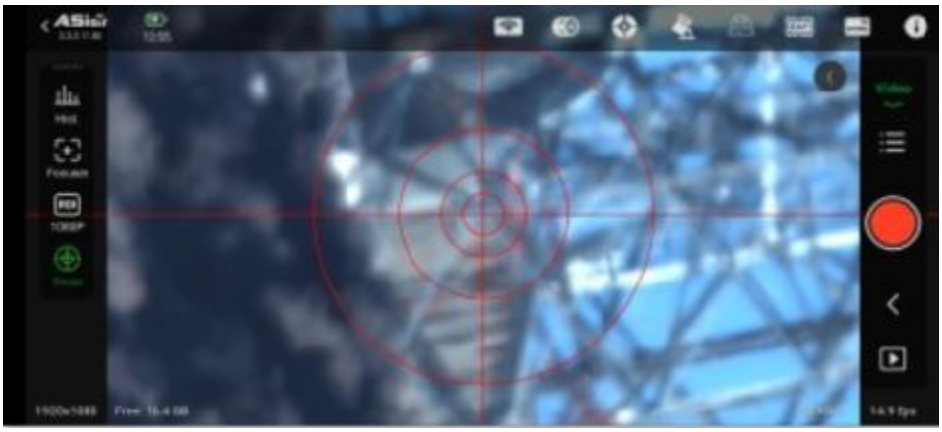
IMPORTANT – I ORIGINALLY USED THIS METHOD BEFORE I REALIZED I COULD USE THE BASIC FOCUS SCREEN EVEN ON TERRESTRIAL OBJECTS. I'M LEAVING THIS HERE FOR A WHILE BUT IT IS FAR PREFERRED TO USE THE STEPS SHOWN ABOVE.

In this example, I will show how I focus on the radio towers at the top of the mountain behind my house.

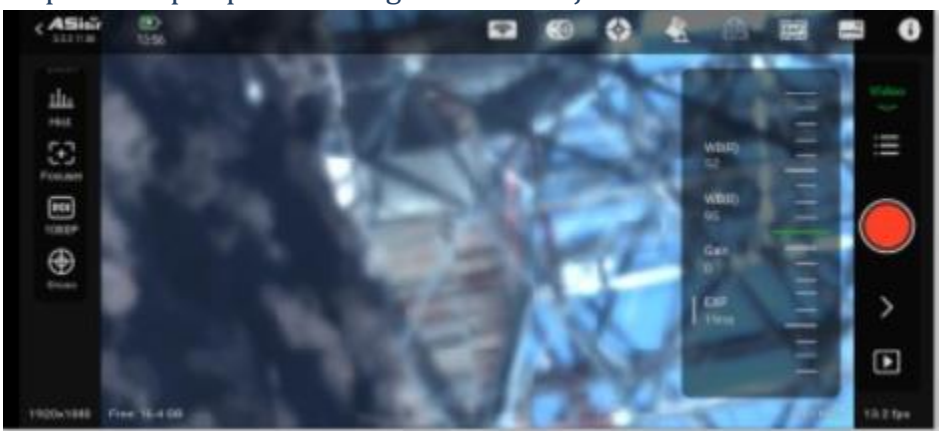
Step 1 – get the object in view

Do whatever is necessary to get the object into the camera field of view. If this is a planet, make sure you have tracking on so the object doesn't wander out of the field of view. If this is a terrestrial object, make sure tracking is off for the same reason.

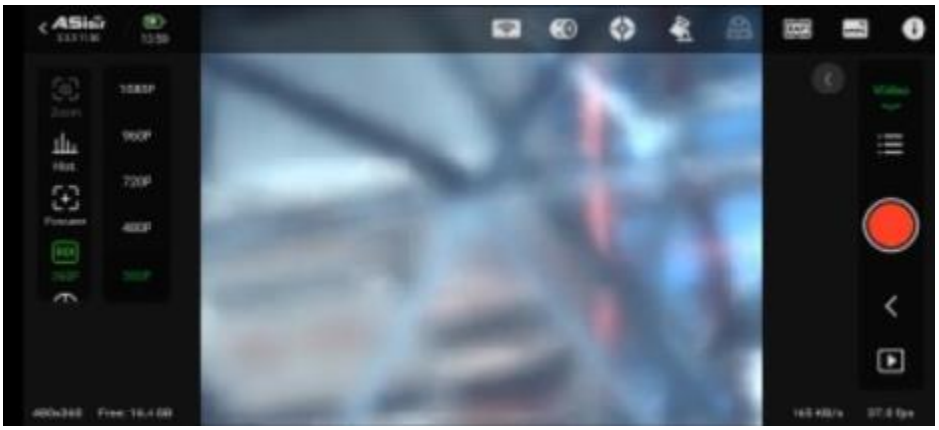
Step 2 – go to 'Video' mode and center the object



Step 3 - setup exposure and gain so the object looks decent



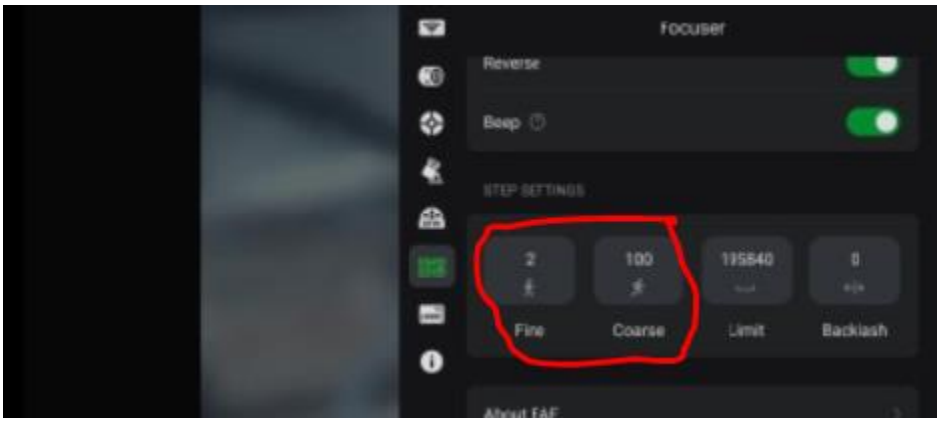
Step 4 – reduce the ROI to be as small a practical



This is critical for two reasons:

1. By reducing the region of interest (ROI) you reduce the amount of data needed to transmit each frame to your phone app – thus increasing the frame rate and making it easier to see your focus changes.
2. If you try to use the full 1080P, ASIAir tends to freeze and get confused when trying to focus. It's as though there isn't enough bandwidth left over to send the focus commands so they get queued for several minutes, which causes you to keep hitting the button, which causes more problems, and eventually you have to restart the ASIAir app.

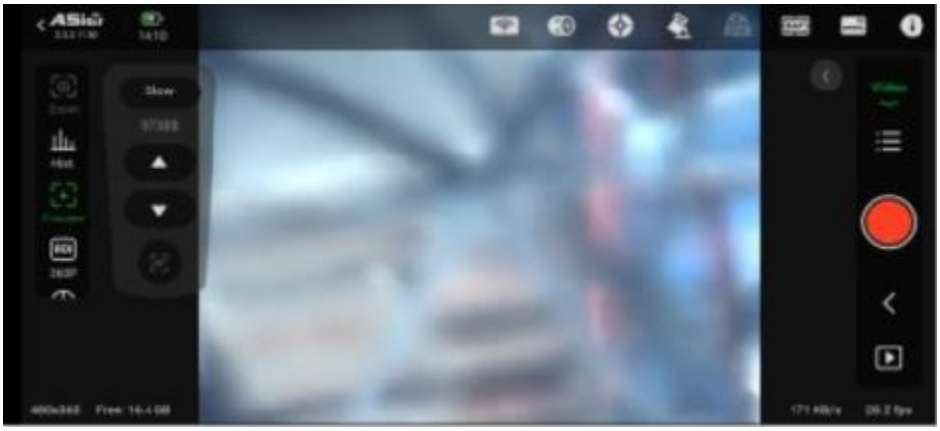
Step 5 – set your EAF focus steps



You may have to do this several times. When you are way out of focus, your Fine/Coarse settings will need to start with large numbers such as 100/500. As you get the object more in focus you will want to use smaller numbers like 2/100.

Step 6 – Adjust the focus

Using the ‘Focuser’ tool, start using the ‘Fast’ (which corresponds to your focuser ‘coarse’ setting) mode and press the up/down arrow buttons until the focus looks best, then switch to ‘Slow’ (which corresponds to your focuser ‘fine’ setting) mode and press the up/down arrow buttons until the focus looks better.



It is often necessary to wait a few seconds after pressing the up/down buttons to allow the focusing mechanism to stabilize and get a good picture.

Repeat steps 5 & 6 until you are able to zero in on the exact focus setting for this object.

Polar Alignment

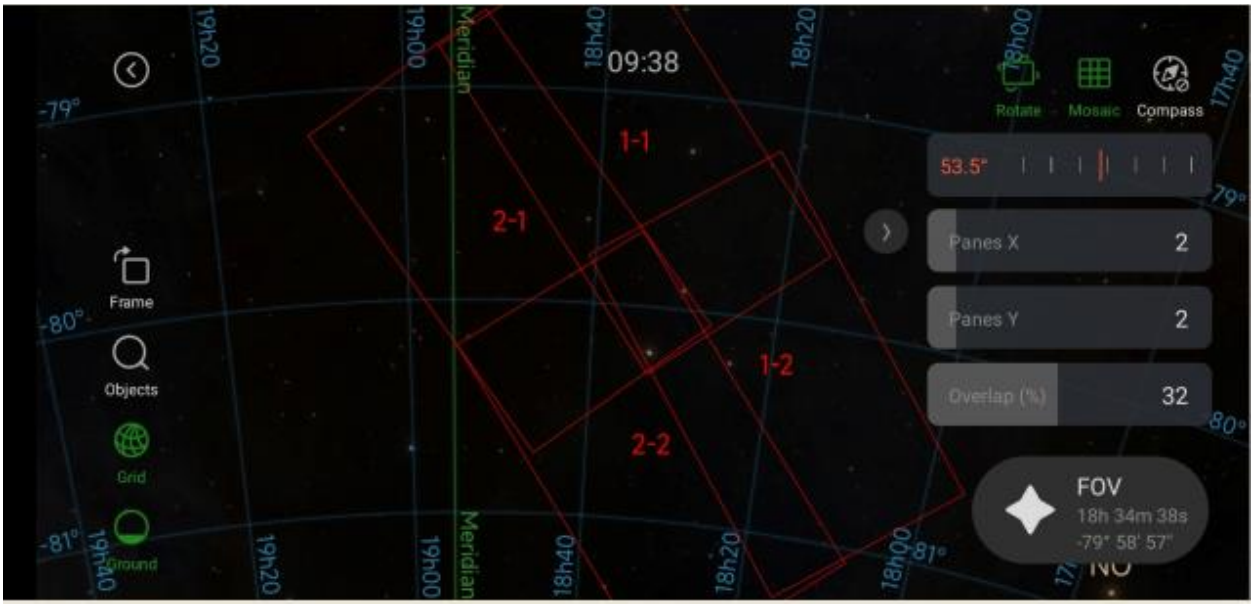
Polar alignment normally works quite well. However, I have run into a very frustrating experience using cameras with smaller sensor chips that are not square (like the ASI585MC.) In these cases, your initial PA shot will work and the second (after the mount tilts 60 degrees) will fail continuously no matter how you adjust the exposure parameters or wait for clouds to move away. In these cases, the solution is to simply rotate the camera somewhat (about 45-90 degrees seems to work generally) so that a different set of stars can be used. For more information about this problem follow this link: Plate Solving Notes.

Aligning the Camera Frame with your Intended Target

This is especially important if your camera sensor is not square because, although the center of the sensor will be centered on your target, your rectangular sensor may not be in the ideal rotational position to capture the target properly.

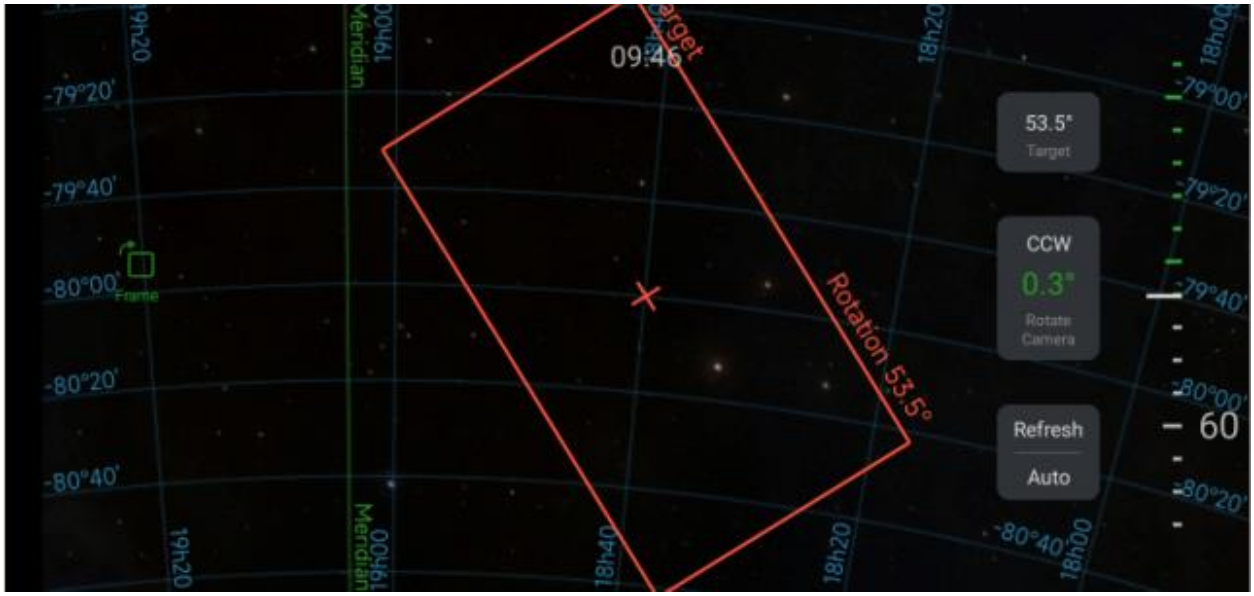
IMPORTANT NOTE: I took these screen shots while the ASIAir was off-line so all the blue camera sensor rectangles are missing. Just pretend that they are present behind the red target rectangles.

This should be done in “Preview” mode. After you have used the “Goto” feature of the “Planetarium” to move the telescope so it is pointing to your target.



- Click on the “Rotate” button on the right top side of the screen.
- Drag the slider that appears around until the target is where you want it.
- If you plan on capturing a “Mosaic” of this object then do these additional steps.
    - Click on the “Mosaic” button and adjust the X and Y frames you want
    - Change the “Overlap” to a reasonable value like 25-30%
    - Tweak the “Rotate” slider until your mosaic is where you want it.
- You can also touch the screen to drag it around until your target is where you want it.

At this point you need to manually rotate the camera so that it matches your target frame. To do so follow the steps outlined below.



- Click on the “Frame” button on the left side of the screen.
- A slider will appear on the right side of the screen allowing you to rotate the red target frame so that the object will look good inside the target frame. If you followed the steps in the previous section your target frame is already where you want it and you can skip this step.
- When you have it where you want it, read the number out of the right-side middle box labelled “Rotate Camera” – this will tell you how many degrees you need to manually rotate your camera to be in your ideal target area.
- Physically rotate your camera, and either press the “Refresh” button repeatedly, or press the “Auto” button once to see where your camera is in relation to your target.
- When the blue Camera box lines up with the red Target box – you are done
- Click on the “Frame” button on the left side of the screen again to exit the frame mode.

In case it is not obvious, this presents a limitation on how many targets you can setup in your “Plan” mode. This is because, in most cases, your targets will not line up exactly the same in the camera sensor frame – requiring manual adjustment between captures in “Plan” mode. For this reason, you should generally create a different plan for each of your targets.

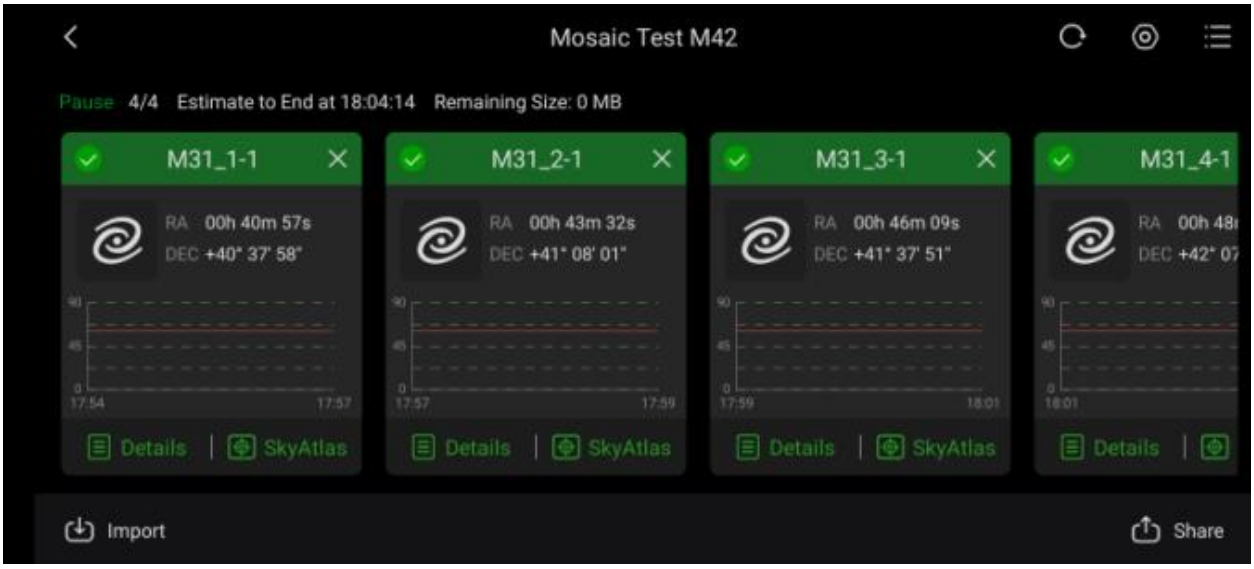
Setting Up a Mosaic

Important: the 'Mosaic' button will be greyed out until the telescope has been polar aligned AND tracking is up and running.

You can only do this in "Plan" mode. **Make sure you align the camera frame before doing this** or else you will end up with cockeyed mosaics like the following.

- Click on the "Planetarium", choose your object and "Goto" it.
- Click on the "Mosaic" button.
- Choose the #of frames in the X and Y directions you want.
- Change the "Overlap" from 10% to something reasonable like 25-30%.

- Click the "+Plan" button (bottom right) and all of your "Mosaic" frames will be added to the current plan and you can see them in the gray bar (bottom left) showing 4 frames.
- Click the "<" back arrow (top left corner) to return to plan mode.
- Continued on next page…



- Click on the first “Mosaic” frame entry’s “Detail” button
- Click on the huge “+” button and setup the camera settings for this image.

  - If you want all of the frames to use the same settings, then click the small “+” button in the top right and select copy to all frames.
  - Otherwise, click on the next frames and repeat the above step.

Running your Mosaic Plan

You can set your plan to run “now”, or “at a certain time” in the plan settings.

There are several confusing points about this.

- Because you can have many plans setup, you need to make sure that:
  - The plans you don’t care about are ‘unselected’ – go into each plan and make sure the green select button is turned off on each of the plan steps.
  - The plan(s) you do care about have the green select button turned on for each step of the plan you care about.
- The “>” play button will be greyed out until at least one plan step is selected.
- Neither of these settings will have any effect UNTIL you press the “>” play button on the plan screen – this is what activates the plan.

At first, I thought this was stupid, but later realized that this is necessary to prevent your plan from running every night if you leave the power on and having the scope crash into adjacent objects in your house.