
Astroid Documentation

Release alpha

DynamicDeepSKY

Jan 07, 2023

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Note: As of 1st July 2022, the user manual is currently under revision. We will do our best to deliver you the final user manual as soon as possible. Thank you for your patience.

Note: 202271

Note: 2022 7 1 . . .

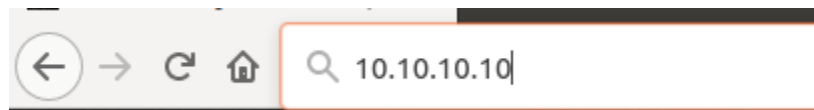
Lastupdate: 15/Aug/2022

Languages

QUICK START GUIDE

1.1 Start Astroid

1. Connect Astroid to a USB power. Make sure to use a stable power source that has at least 5V 3A capacity.
2. Open up your wifi setup on your mobile device or desktop and find DDS_DIRECT_your_serial. Password is 12345678
3. Open your web browser and type 10.10.10.10 or astroid.local



Note

If 10.10.10.10 does not work try <http://10.10.10.10> instead of 10.10.10.10. Some web browsers add https in front of the IP address which make it fail to find the device.

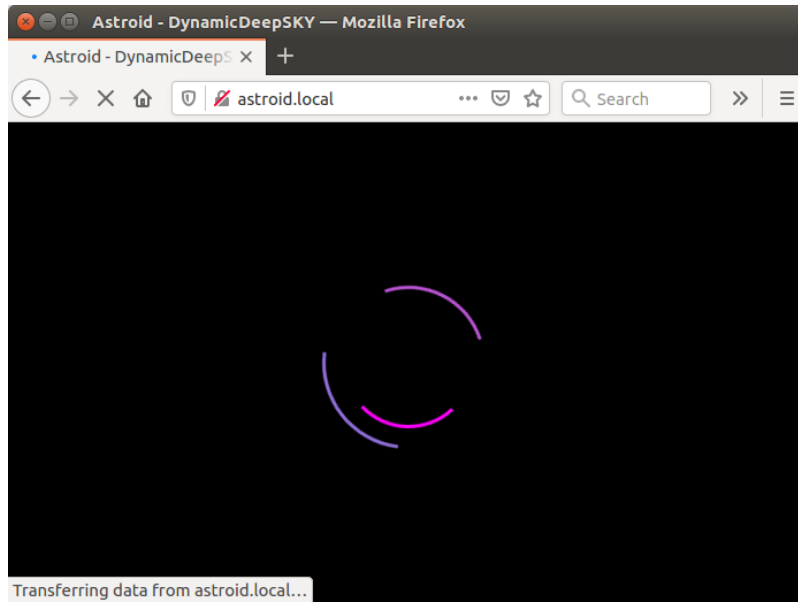
<http://10.10.10.10> (O)

<https://10.10.10.10> (X)


4. You should see the rotating logo soon

Note

The system wake-up usually takes about a minute. If you can't find the SSID in 2 minutes after connecting the power, try to reboot the system by disconnecting and connecting the power. If you can't start the system after multiple trials in this way, your power source might be not enough to stably run Astroid. Please try another power source. For more information, please refers to the manual.



1.2 Quick Menu

For quick control of the camera, open the quick menu by clicking the menu icon  on the top left corner.

Exposure: Sensor exposure time. Longer exposure is available in the setting menu.

Gain: Sensor gain. High exposure drastically increases noise. Enabling stacking or increasing exposure will reduce the noise.

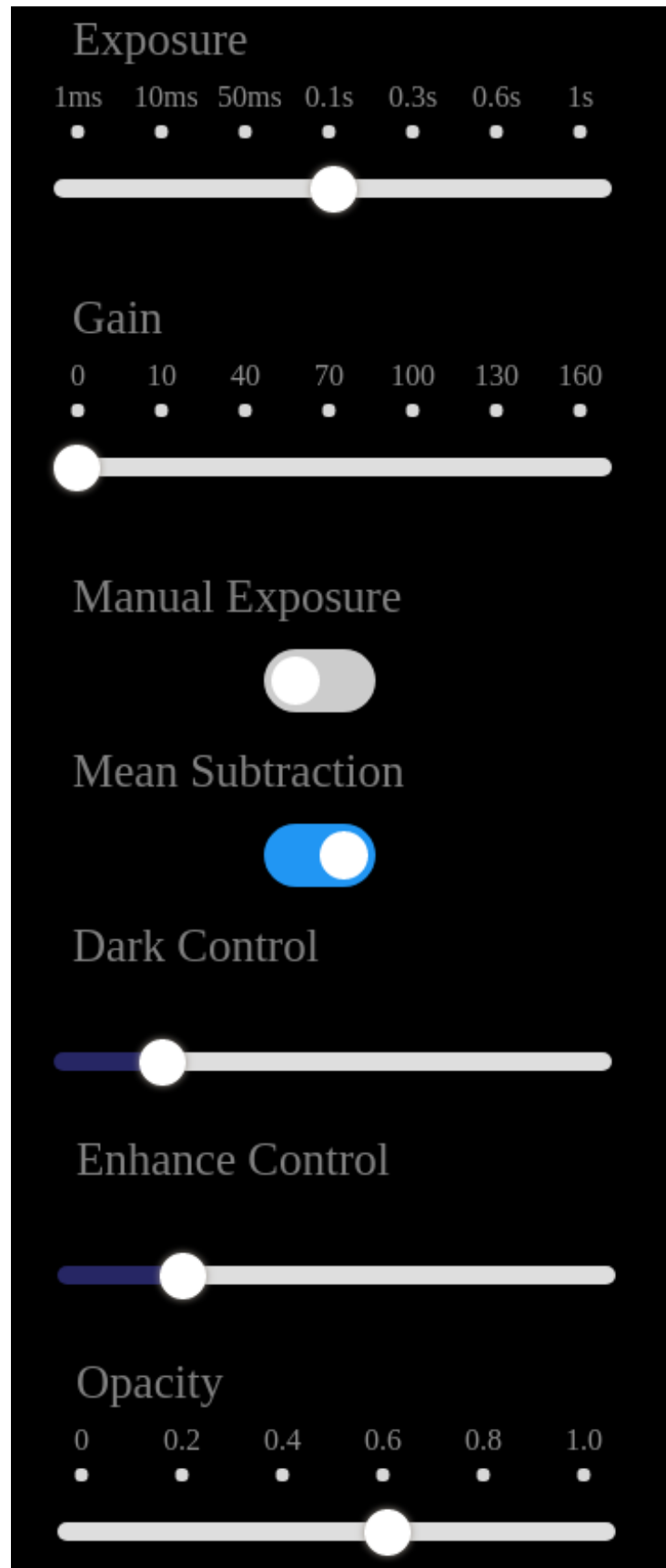
Manual Exposure: Enabling this will automatically adjust gain or exposure to meet the desired image brightness. More auto exposure controls can be found in the setting menu.

Mean Subtraction: Enabling this will subtract the mean pixel value from the entire image to remove light pollution.

Dark Control: Move the slider to the left to make it darker. This only works when the stacker is enabled.

Enhance Control: Moving this slider to left will amplify a small image signal. This can be used to observe a faint object.

Opacity: Adjust this slider to control line brightness.



1.3 Lens Mount




Astroid Multi can be used in two different ways. If you would like to use the sky recognition feature in **eFinder** and **Dr. Pole**, please mount the provided 5mm lens to the camera body.

1.4 eFinder


This feature of Astroid completely substitutes the conventional dot finder or finder scope. With the built-in image sensor and the basic lens, you can use Astroid as an electronic finder. Astroid's eFinder does not just show you a sky image but can tell you what are you looking at and guide you to the sky objects you would like to see.

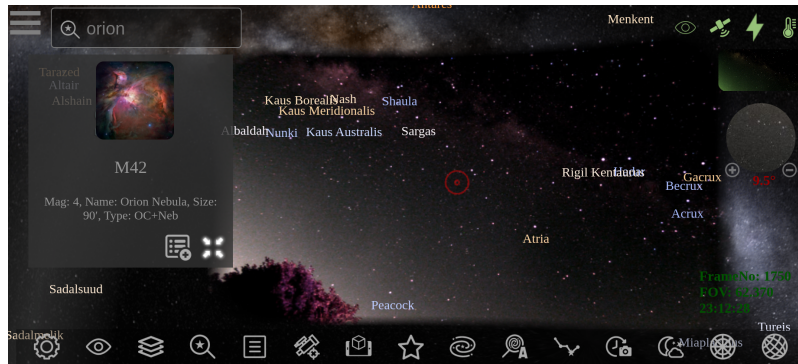
1.4.1 Starting eFinder


Follow the procedure below to start eFinder.

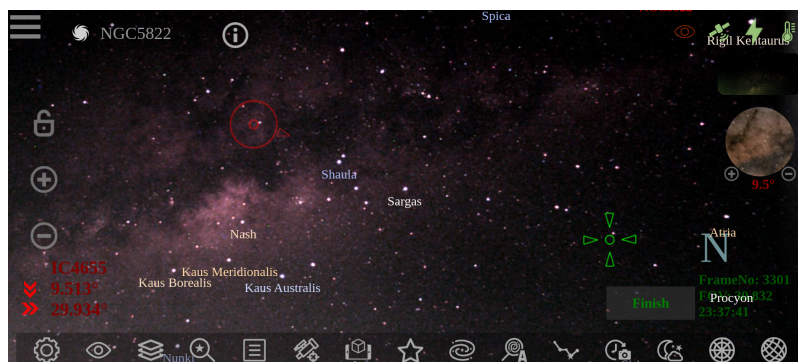
1. Mount the holder to your telescope.
2. Slide Astroid camera into the holder and lock the bolt on the holder using the provided hex key.
3. Rotate the lens to adjust focus if it is the first time. But the focus is adjusted to the right position when assembled in the factory. Please do this step only when required.
5. Click the eye button  to start live sky recognition.
6. If you would like to use 3D planetarium, you need to enter your GPS location in the system. However, if you don't want to put GPS or GPS information is not available, use AR mode  instead. AR mode represents the night sky with respect to the image. Refers to the next section for more details on GPS location. Automatic GSP setup will be available in the future update.
7. Align Astroid to the main telescope lens. To show the alignment joystick, click align icon  on the down side icon bar. See the next section for more details.

1.4.2 Star Searching with eFinder

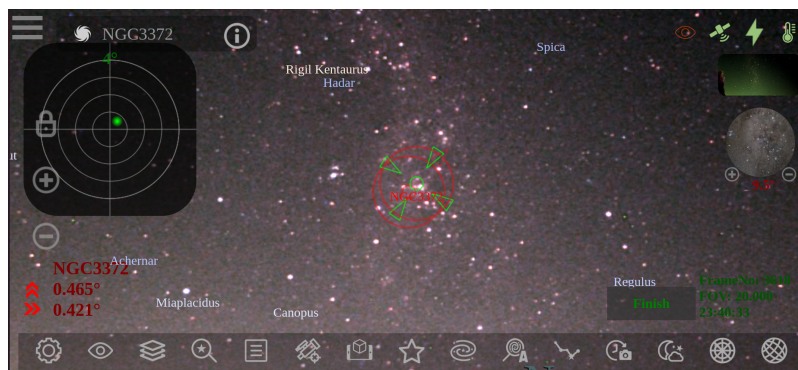
1. Touch/click the finder icon  on the bottom and search any object you want to find by typing a star ID or name. You can use search keyword such as “M1”, “ngc3372”, “orion”.



2. Touch the location preview icon  to see the location and trail of the star or touch the photo to start the guide mode. The guide mode will tell you which direction you should move your main telescope to see the target star.
3. Red target mark is what your main lens is looking at and the green mark is where you need to move your telescope. The small arrow around the red target is the direction you should move to.



4. Move your mount slowly so that the red target mark and green mark meet
5. When the target star is close to the main scope, a fine tuning target board will appear on the top left corner to assist you with fine movement.




- If you see the target object in your main telescope's eyepiece, terminate the guide mode by clicking "Finish" button on the left bottom corner.

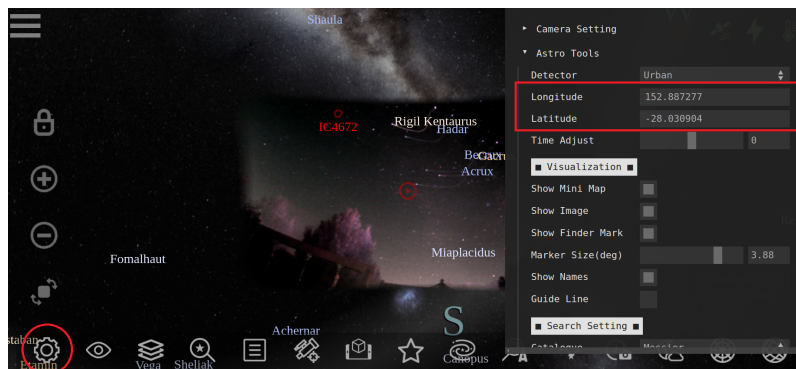
Tips

Once the sky is recognized, move your mount slowly so that Astroid does not lose the recognized stars. Once it lost the stars, it will take about 2~5 seconds to recover.

1.4.3 GPS Location

The 3D planetarium feature requires the GPS location to draw the night sky pattern above your location.

If it is the first time use or the location you use Astroid is far away from the last location, update the longitude and latitude value under **Astro Tools** menu. Click the setting  icon to show the menu.



If you don't know your longitude and latitude, go to google maps and see what is your longitude and latitude. **This manual GPS input will be changed to automatic in the future update.**

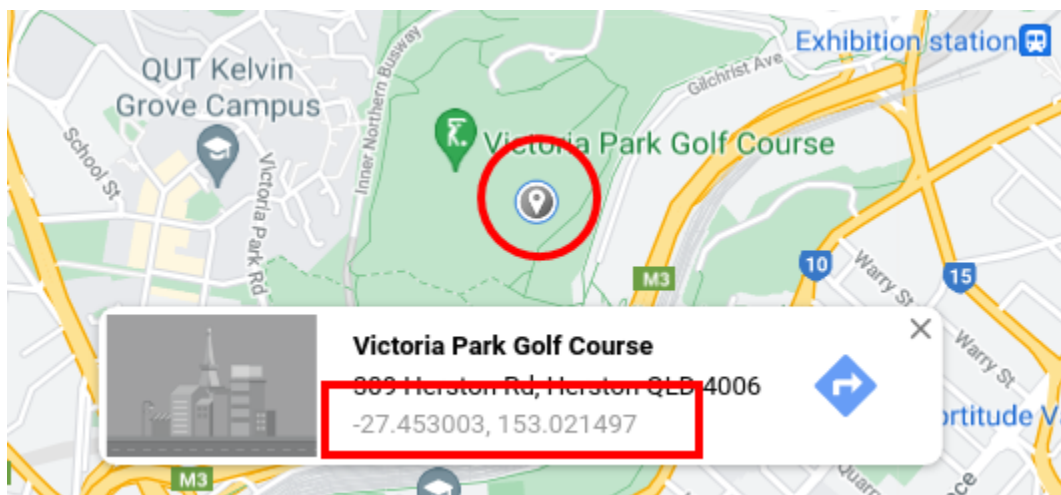


Table 1: example longitude and latitude

Location	long	lat
Australia Brisbane	152.887277	-28.030904
Korea	127.667991	36.664273
New Zealand	174.807480	-36.866884
Italy milano	9.184879	45.466708
US Kansas	-98.139525	38.396799
Japan	140.002557	35.736418

1.4.4 ARZoom



ARZoom will show you a virtual view of your main telescope. If you set it to the same FoV of your eyepiece you will see the same view as the ARZoom image in your eye piece. Note that the red circle is your main telescope view and ARZoom will display the sky image around the red circle. You can zoom in or out as you want by pressing +/- button under the ARZoom window.

This feature only works when the sky is recognized.



1.4.5 eFinder Align

If you would like to use Astroid as a finder along with your main telescope, you have to align Astroid to your main telescope view just like what you do with a conventional finder scope but in a digital way. Follow the procedure below to align Astroid to your main lens.

1. Adjust your telescope to put a bright and distinctive object in the center of the eyepiece. Street light or house window light is useful for this. Starlight is not recommended as it is not very distinctive and is moving.
2. Press the eye button  to start sky recognition mode.
3. Press the align icon  on the down side icon bar to turn on the align mode.
4. Identify the location of the bright object in the image
5. Adjust the joystick to move the red target mark toward the object

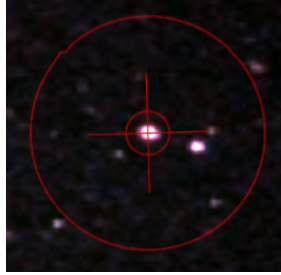


Fig. 1: Target mark

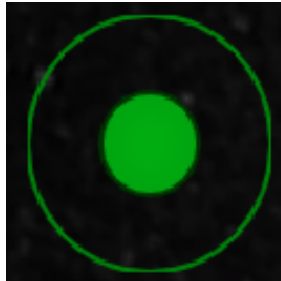



Fig. 2: Joystick

6. Press the align icon  again to terminate the align mode. This will automatically save the current location so that you do not need to do the alignment next time.

Tips

Zoom out to move fast and zoom in for fine tuning. Target mark move speed changes according to the screen view angle.

Important


The first alignment is highly recommended to be done at sunset rather than a dark night. If you have a bright object like a street light around your telescope point your telescope to that object and then use the joystick to move the target mark. But the alignment can be done at night too using stars.

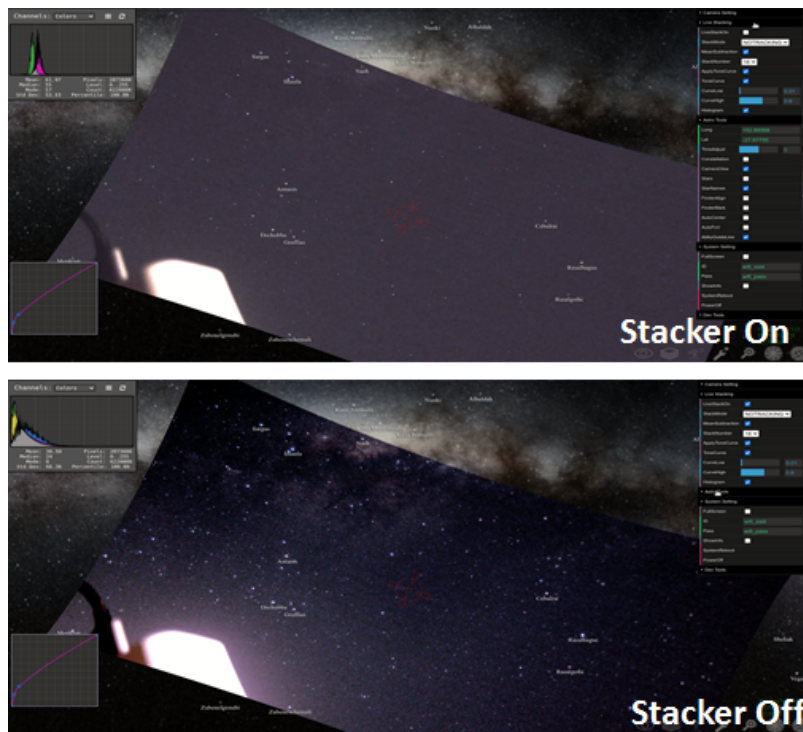
1.5 Live Image Stacking


Electronically Assisted Astronomy (EAA) stacker offers a set of tools that make the live stacking and registration easy. You can use this feature either for the basic lens, DSLR lens, or telescope.

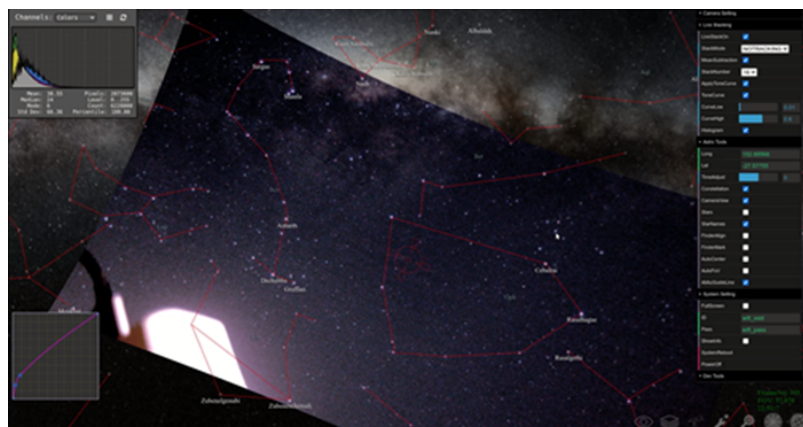
1.5.1 Basic Lens

When the stacker is used with the basic lens, you can observe the Milkyway in real-time.

To use the EAA stacker with the basic lens, just click the stack icon .



When stacking is enabled in eFinder mode, the stacked image will be aligned to the sky. You can enable eFinder features such as displaying a constellation  as shown in the following example.




Also, once the sky is recognized you can click and figure out the name of the shiny sky object.

1.5.2 Custom Lens

DSLR lens or telescope lens can be mounted on Astroid after removing the basic lens. When EAA stacker is used with these two types of lenses, it will give you a much brighter image of the sky object than observing them with the bare eye.

If you use a high magnification lens, turn on Auto registration mode. EAA stacker will automatically register moving star images to the first image so that you can observe the target without a star tracker.

Follow the procedure below to use EAA stacker with a DSLR lens or telescope lens.

1. Slide the camera into 2 inch scope eyepiece holder. Optionally you can use provided 1.25 inch extension tube to slide it into an eyepiece hole on your telescope.
2. Set exposure to 0.3 seconds and gain to 150 for fast focusing
3. Adjust your telescope's focus knob and see any star appears on the screen. Finding the right focus could be a challenging job if you do it at night. Do it when it is not too dark and leave a mark around your telescope focuser so that you can easily set the focus to the near position next time.
4. Click the stack icon  on the bottom icon bar to start the image stacking. Image tone curve setting is automatic by default but for an advanced user it can be adjusted to make it look better.


Stacking will show the best result if F number is low e.g. F2 or lower.

Stacking result on Samyang 85mm@F2.



The following shows the images captured with Astroid on Celestron 90GT without the mount star tracking on.

1.6 Timelapse

You can record the images to make a timelapse. Press the timelapse icon  to start the recording after inserting a DDS USB. Refers to [Making DDS USB](#), regarding a DDS USB.

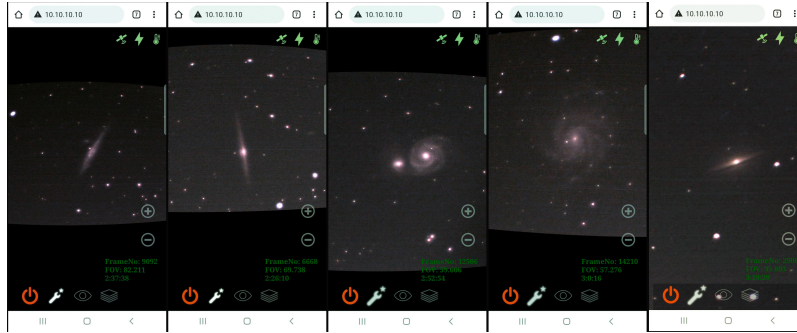


Fig. 3: Image credit: youtuber in

1.7 Polar Alignment with Dr. Pole

Dr. Pole is a standalone polar alignment assistant tool for EQ mounts. Compared to the existing solution, **Dr. Pole does not require the pole star to be within the camera view** which makes the polar alignment much easier when you are in the Southern hemisphere or when the pole star is not visible around your place due to a tree or building.



Follow the procedure below for the polar alignment.

1. Mount the holder to your telescope.
2. Slide Astroid camera into the holder and tighten it.

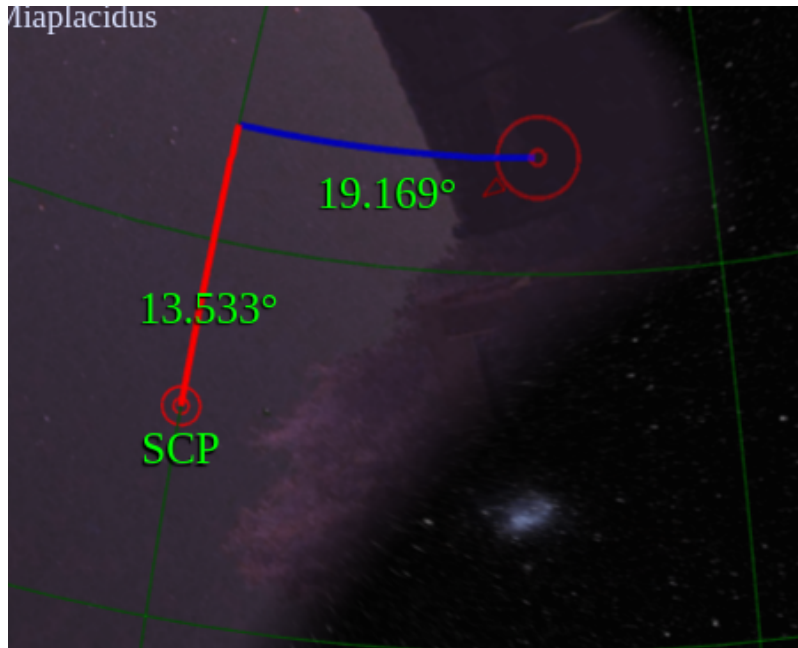


Tips


Not like the other products, Astroid can be mounted on the DEC axis or directly on the telescope tube. This gives you more flexibility when the pole star is not visible. But you can mount Astroid on the RA axis too.

3. Click the eye button  to start live sky recognition and wait until the sky is recognized.
4. Click the telescope icon  on the bottom icon bar.
5. Move the RA axis of the telescope to the first position (-30 degrees) and wait until the sky is recognized
6. Press the next button and move the RA axis again to 0,+30 degrees and repeat 6,7 for two more times.
7. Once the axis finder is normally finished, you can start the alignment mode by pressing the “Start” button on the right downside corner.

8. The red circle mark is your rotation axis and SCP/NCP is the pole location. Adjust your mount base according to the guideline so that the red circle mark is close enough to the pole location.



1.8 How to Turn Off Astroid

1. Press PowerOff button 
2. Wait until you see the goodbye message on the screen
3. Unplug the power

Important

If you cut the power without parking, sometimes the SD card is corrupted and you have to recover it to the factory setup.

WEB INTERFACE

2.1 User Interface Layout



1. Camera image
2. Quick control icon bar
3. Status icons
4. ARZoom image
5. Quick menu
6. Search
7. Search result

2.2 Status Icons



Power normal



Unstable power



Sky recognized



Sky recognition failed



Don't eject USB



System update in progress



GPS valid



GPS input required



Inave save on



CPU temperature is in a normal range



CPU is overheated



USB recognized

2.3 Quick control icons



Screen lock/unlock



Zoom in



Zoom out



Image rotation



Advanced setting menu open/close



Live sky recognition on/off



Staker on/off



Star search



Open/close star list



Camera align mode on/off to the main telescope



Augmented reality mode on/off



Star display on/off



DSO display on/off



Nearest DSO auto display on/off



Constellation display on/off



Time lapse start/end



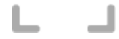
Night mode on/off



Elliptical grid on/off



Azimuth grid on/off



Full screen mode (Android and Desktop only)



Polar align mode start



Image download



Eject USB memory



Refresh screen



Power off

2.4 Camera Control Menu

Auto Mode: Auto exposure mode selection. AUTOGAIN fixes exposure and only adjusts the gain.

Brightness: Sensor auto exposure level. Gain or exposure will be automatically adjusted to meet this value.

Exposure: Sensor exposure time in second.

Gain: Sensor gain.

Image Quality: JPG image quality in percentage. A higher value increase file size and image quality but slower the frame transfer rate.

ZoomMode: Turn on this option to receive the cropped image at a faster frame rate. This option is useful when adjusting the focus.

ZoomSize: Image size in pixel.

Mean Subtraction: Check this option to subtract the mean pixel value from the image. This can be used to remove light pollution from the image.

Mean Low Cut: Mean subtraction level.

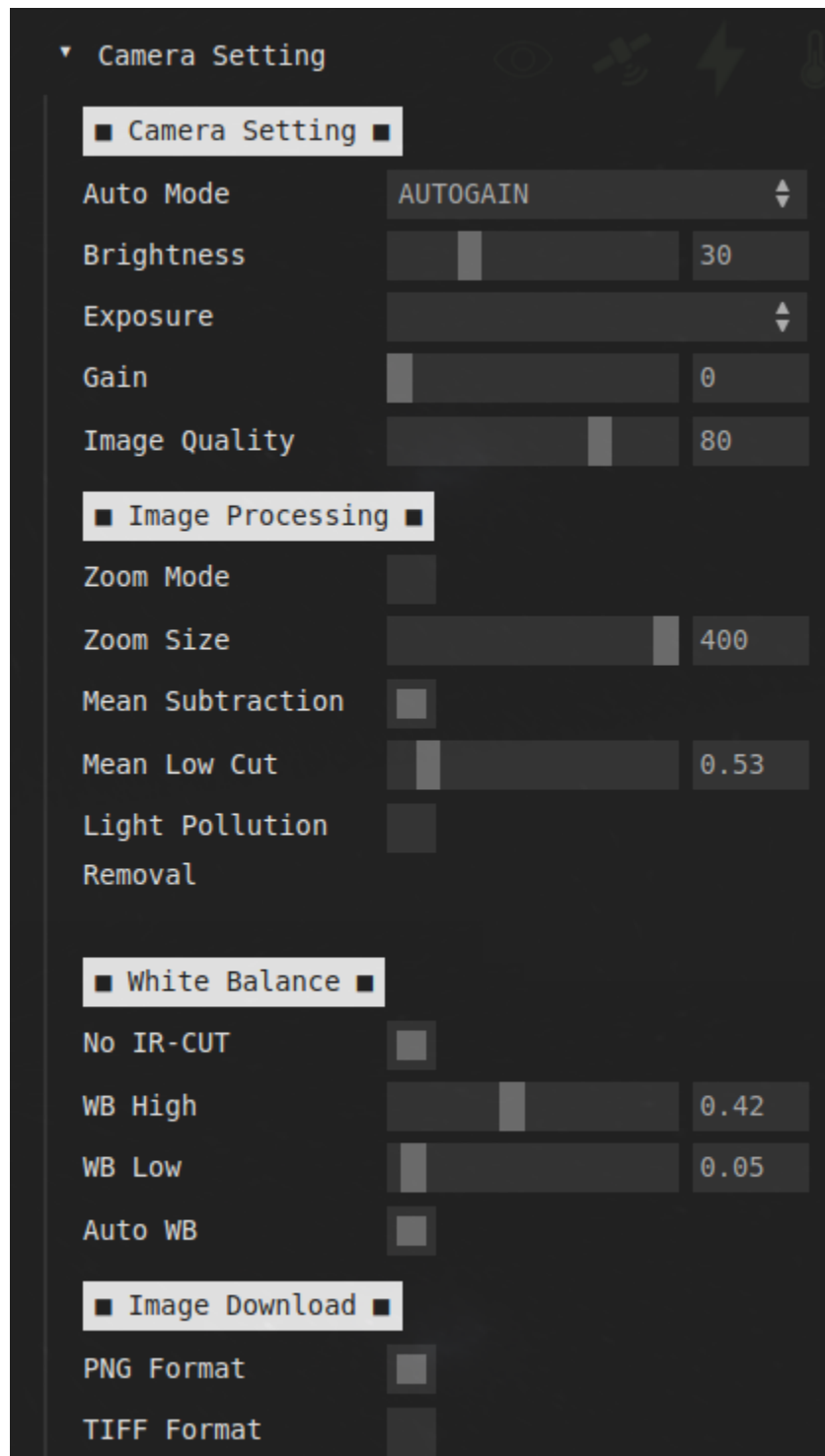
Light Pollution Removal: This will remove the gradient caused by light pollution. Note that Mean Subtraction above cannot handle light pollution with gradient.

No IR-CUT: Check this option when the IR-CUT filter is removed. This will disable the wrong color correction.

AUTO WB: Automatic white balance. Select this option when IR-CUT filter is removed. The system tries to adjust the white balance without IR-CUT filter.

PNG Format: Png format image download.

TIFF Format: Raw format image download.



2.5 Astro Tools Menu

Detector: Star detector method selection.

Longitude: Longitude of your location.

Latitude: Latitude of your location.

Time Adjust: This can adjust system time to preview the sky at a given time

Show Mini Map: Mini image turn on/off

Show Image: Uncheck this option if you only want to see the red circle marker

Show Finder Mark: Uncheck this option if you want to remove the red circle marker

Marker Size: Adjust this slider to adjust the red circle marker size identical to your main telescope

Show Names: Uncheck this if you want to hide all names

Guide Line: Check this option if you want to see azimuth and elevation guideline in guide mode

Catalog: This is the star catalog that the automatic nearest star search feature uses.

Min/Max Size: Any DSO larger/smaller than these values will not be automatically searched. Adjust the min/max value according to your main telescope's field of view.


Max Distance: Search boundary. A larger value will search a wider area.

Min/Max Mag: Any DSO darker/brighter than these values will not be automatically searched. Adjust the min/max value according to your preference.

Sort By: When the auto search button is clicked in the star list, the found stars will be sorted by this option.

RA(h:m:s), DEC(h:m:s): Custom RA, DEC location for comet and etc. Click "Add to the list" button to add the custom location to the star list.

2.6 Timelapse Menu

You can select different formats for the timelapse image saving feature. When you press the timelapse icon , the system will write the images in the format you selected above.

Tiff and png format will save raw images whereas "Save Annotated" will save the image with additional information such as the direction of the main telescope

2.7 System Setting Menu

Support Mode: Check this to let our support team remotely diagnose your device. Please speak with our support team first before you use this option.

ID: External wifi's SSID

Pass: External wifi's password

Email: Put your email here to receive the IP address of the device when it is connected to the network. Note that the email from Astroid is often filtered and delivered to your spam email box.

▼ Astro Tools

Detector

Urban

▲▼

Longitude

152.887277

Latitude

-28.030904

Time Adjust

0

■ Visualization ■

Show Mini Map

☐

Show Image

☐

Show Finder Mark

☐

Marker Size(deg)

3.88

Show Names

☐

Guide Line

☐

■ Search Setting ■

Catalogue

NGC

▲▼

Min Size

0.1

Max Size

1000

Max Distance(deg)

0.5

Min Mag

20

Max Mag

0

Sort By

Distance

▲▼

■ Custom Location ■

RA(h:m:s)

0

DEC(d:m:s)

0

Add to the list

■ Colors ■

Target Mark

0.5

Opacity

Target Mark Color

rgb(18, 52, 86)

Constellation

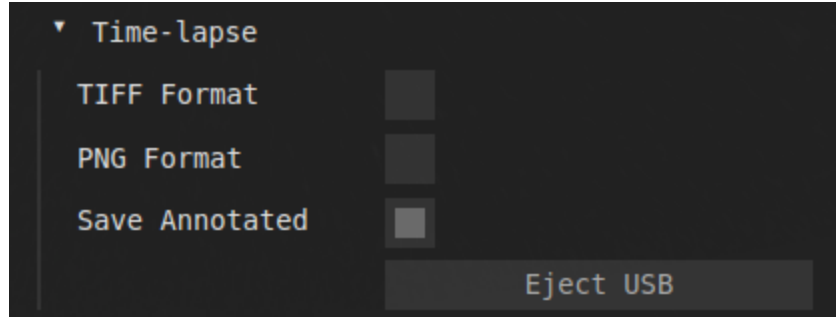
0.5

Opacity

Constellation

rgb(18, 52, 86)

Color



Phone: Enter your phone number in international format to receive the IP address. The message will be sent only once a day.

Table 1: Dialing codes

Region	Number
Japan	+61
Korea	+81
Australia	+82

For example, if you connect your device in Australia with the phone number 0401 123 456, you should put it as follows.

Get License File: You can download your license file by clicking this button. The downloaded license file can be used to recover your license setting after you recover the system. If you have not stored this license file, download the system ID by clicking “Get System ID” and contact us.

2.8 Collimation Menu

Camera: Currently only internal camera is supported

Focus: Focus control for the external auto focus camera

X Offset: To move the circle around x axis

Y Offset: To move the circle around y axis

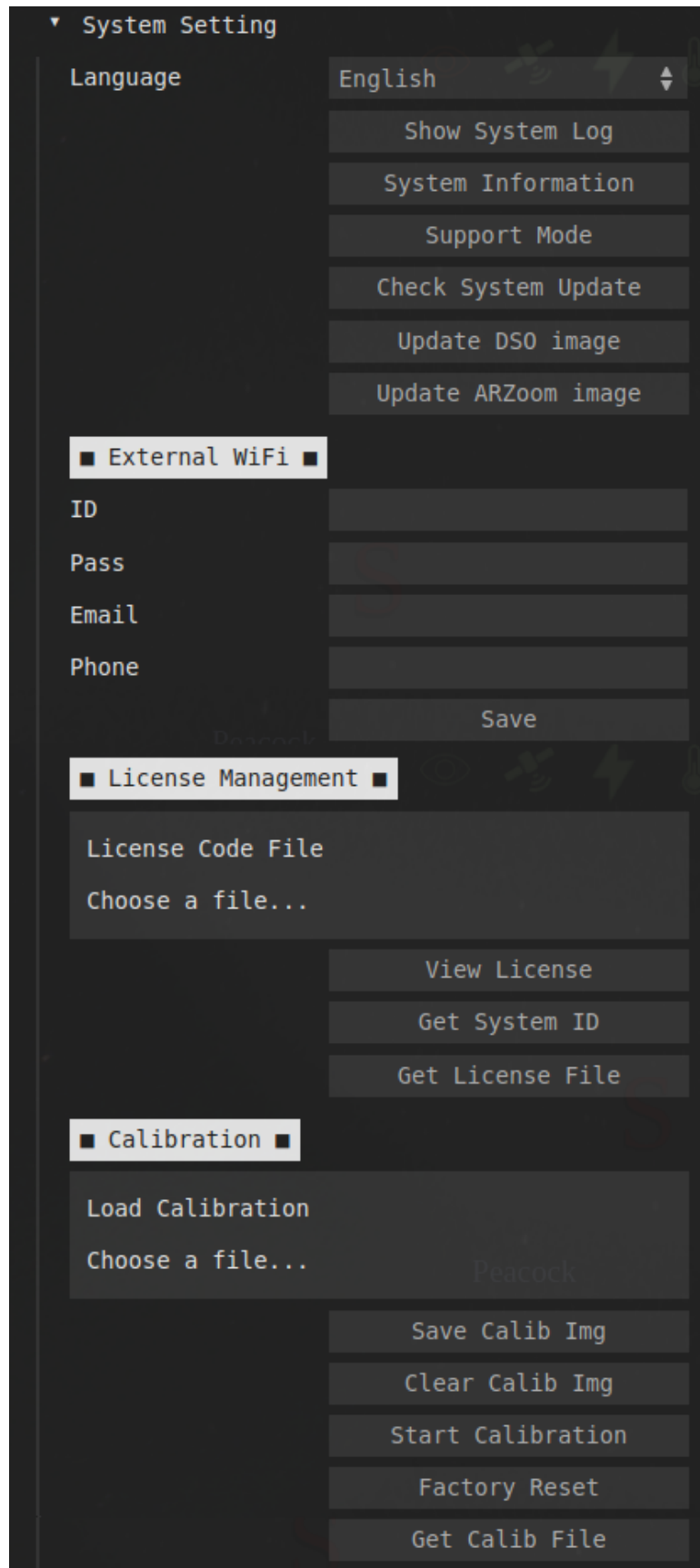
2.9 Setting Up License

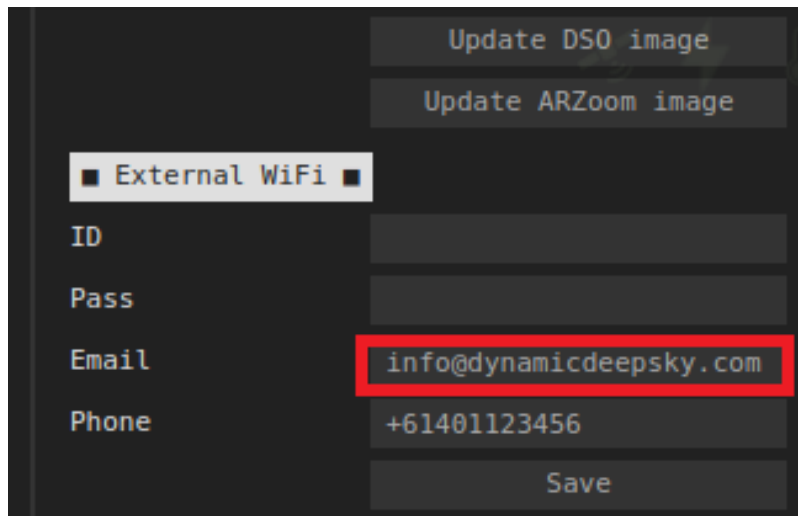
Astroid’s basic system and apps are protected by HW license keys. For this reason, if you recover your device from the recovery image, you have to recover the license as well. This requires uploading the license file to the web interface. The license file can be downloaded by clicking “Get License File” button in the system setting menu. It would be a good practice to download the license file and store it on your computer once you receive the device.

To upload the license file, go to the system setting menu and click **License Code File** button and select the license file you stored on your computer.

In case you can’t access the license file, please send us your system ID and serial number. Our staff will send you the license file as soon as possible.

Also, if you replace Raspberry Pi 4, the original license code would not work. So, if you have any Raspberry Pi related problems, please contact us rather than replace the Raspberry Pi yourself.





Update DSO image

Update ARZoom image

■ External WiFi ■

ID

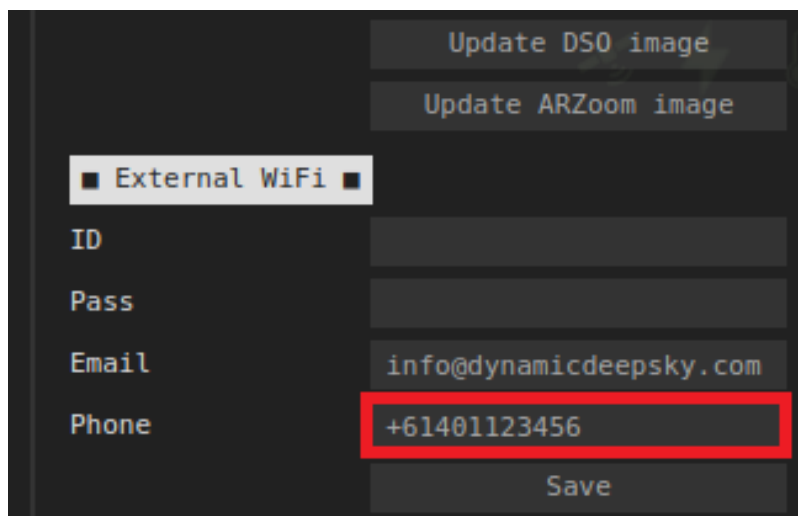
Pass

Email info@dynamicdeepsky.com

Phone +61401123456

Save

This screenshot shows a web interface for configuring external WiFi. At the top are two buttons: 'Update DSO image' and 'Update ARZoom image'. Below them is a section header '■ External WiFi ■'. Under this header are four input fields: 'ID', 'Pass', 'Email', and 'Phone'. The 'Email' field contains the text 'info@dynamicdeepsky.com' and is highlighted with a red rectangular border. The 'Phone' field contains the text '+61401123456'. At the bottom of the form is a 'Save' button.



Update DSO image

Update ARZoom image

■ External WiFi ■

ID

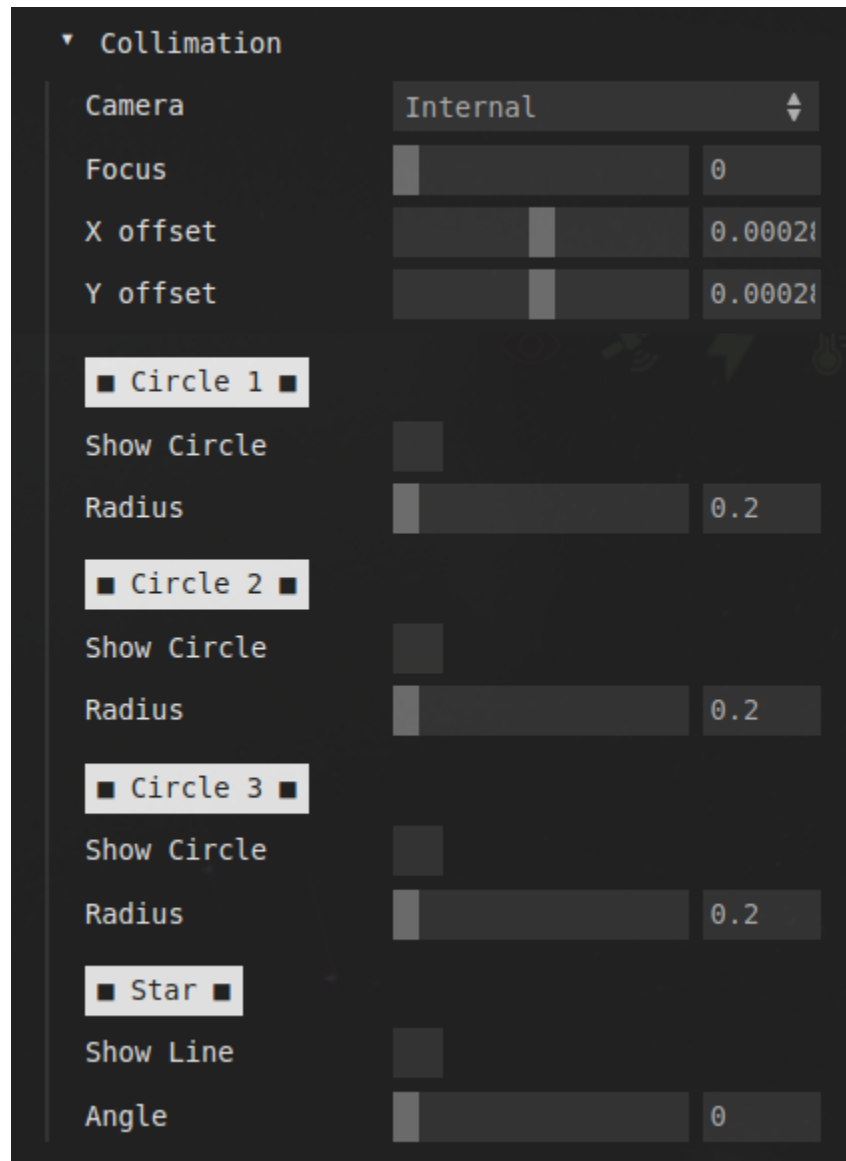
Pass

Email info@dynamicdeepsky.com

Phone +61401123456

Save

This screenshot shows the same web interface as the first one. The 'Email' field now contains the text 'info@dynamicdeepsky.com'. The 'Phone' field contains the text '+61401123456' and is highlighted with a red rectangular border. The 'Save' button remains at the bottom.




2.10 Hot Pixel Correction

The number of hot pixels naturally increases over time. These hot pixels are especially noticeable if you run EAA stacker with tracking option on. Astroid has a built-in hot pixel detector and corrector. But to correct the hot pixel you need to manually activate the hot pixel detector. Please, follow the procedure below to detect and correct the hot pixels.

1. Completely block the sensor using the provided sensor lid. Turn off every light around the room and make the room completely dark.
2. Go to the camera setting and increase exposure to 1 second and set the gain to 150.
3. Go to the system menu and adjust the hot pixel level. A lower value will pick more hot pixels.
4. Click the hot pixel correction button.
5. Run EAA stacker and see if hot pixels are disappeared
6. Try with the default value and if you still see some weak hot pixels, lower the value and repeat the above until satisfactory.

2.11 Writing Images to USB Memory

1. Prepare a DDS USB. Refer to the next section to make a DDS USB
2. Insert the USB to Astroid and see if USB icon  appears on the top status bar
3. Click the timelapse button to start recording

Warning

Use high-speed USB memory only. With low-speed USB, Astroid will continue to write files to USB even after you finished recording which will drastically increase the chance of file corruption.




How to eject

USB must be ejected after the eject button is clicked and all the USB related icons are disappeared. Otherwise, the USB will be corrupted and you will lose all data in the USB.

2.12 Making DDS USB

1. Prepare a SanDisk 32GB Ultra Fit or equivalent. High-speed USB memory is highly recommended to prevent any data lost
2. Format the disk with NTFS format and change the name to DDS.
3. Insert the USB to Astroid and see if the USB icon appears on the top.

EFINDER

Clicking the eye button  on the downside icon bar will switch Astroid's operation mode to eFinder and activate live sky recognition. Before you use eFinder, make sure the sky is recognized. The red eye icon  on the status bar will turn into the green eye  when the sky is recognized.

Important

Note that the sky recognition mode only works with the provided 5mm lens. You can mount other lenses to use Astroid as a camera but the sky recognition would not work.

3.1 Sky Recognition

When the sky recognition is activated, Astroid will try to recognize the sky but it might fail in some cases. If the sky recognition status icon does not turn to green in 5 seconds try the following.

- Check if the lens focus is correct. With the blurry focus, Astroid does not recognize stars well.
- Make sure there are enough stars in the image.
- Adjust the gain/exposure a bit higher or lower. The image should not too bright or dark. Note that adjusting exposure to higher slows down the response speed.
- Point the camera to a direction where no cloud, moon, the building exists. Usually, it takes more time to recognize the sky when there are obstacles in the view. Once it is recognized slowly move the camera in the desired direction.

3.2 Light Pollution

One of the dominant factors that affect sky recognition performance is the sky condition. The best sky condition would be a very dark sky under Bortle 6 without the moonlight. Bortle is a metric to estimate the amount of light pollution in the night sky. You can easily see the Bortle level of your place from the following site.

<https://www.lightpollutionmap.info/>

The following example shows the Bortle level of three different places around Brisbane city.

Although it might work, the sky recognition performance is not guaranteed around the high light pollution area above Bortle 6. Refers to the following table for the details of Bortle class.

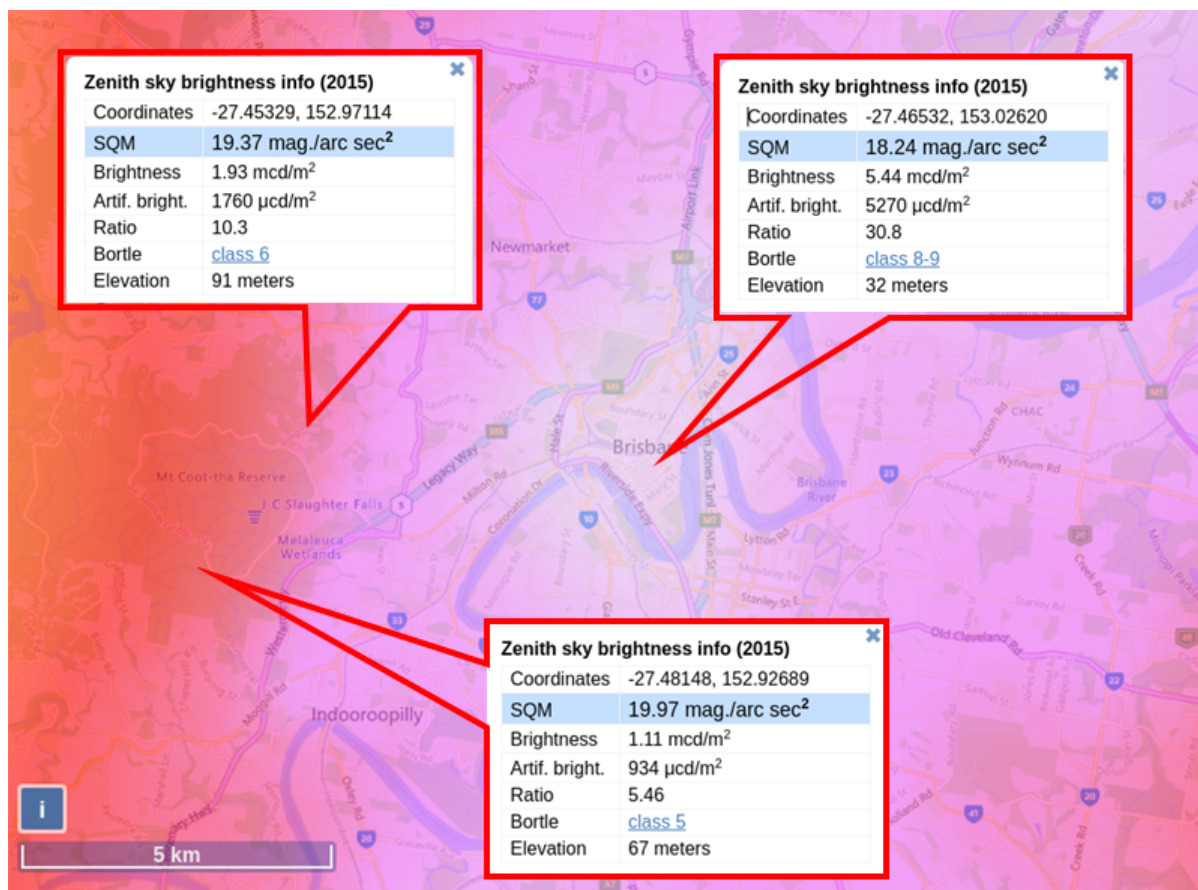


Table 1: Bortle Class

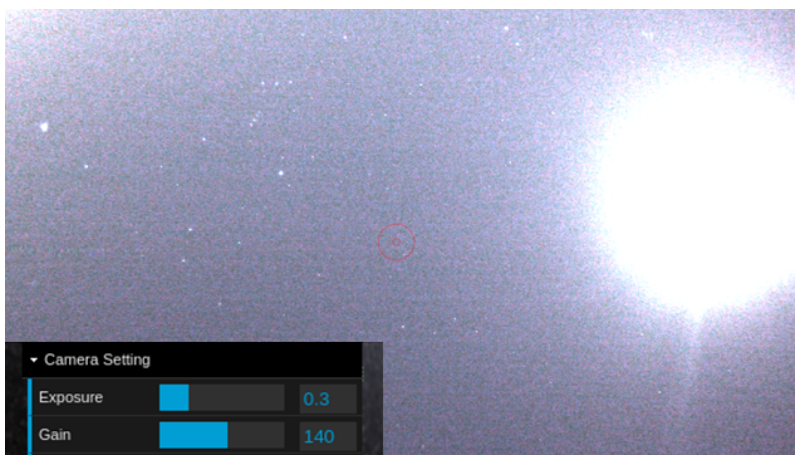
Sky Condition	Bortle Class
Excellent dark sky	1
Average dark sky	2
Rural sky	3
Rural/Suburban transition	4
Suburban	5
Bright suburban	6
Suburban/urban transition	7
City sky	8
Inner city sky	9

3.3 Sky Recognition with Moon Light or Light Pollution

Although it is recommended to be used under Bortle 6 and without the moonlight, if you can't avoid such an environment there is a trick that you can do to make eFinder works but with limited speed and accuracy.

The default setting of sky recognition is 0.3 sec for the exposure and 140 for the gain which is optimized for Bortle 5 without the moonlight. The low exposure helps to increase response speed but needs a high gain setup which results in a noisy image under light pollution and the moonlight condition. Noisy image decreases the sky recognition performance.

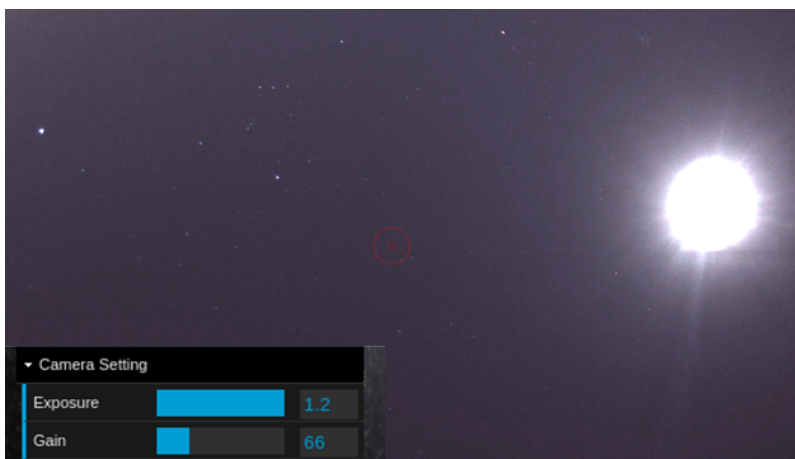
A simple solution is compromising the response speed by increasing exposure and lowering the gain. The following example shows how the exposure and the gain setup reduces noise moonlight conditions.



3.4 Automatic DSO search

Automatic DSO search is very useful when you would like to run a free-style sky exploration without any preparation. Enabling this will automatically find the nearest DSO to the current main telescope's view and display its shape and id on the screen.

By default, this feature will show sky objects in NGC, but you can select another catalog under "Astro Tools Menu" -> "Search Setting". Also, you might don't want to find too small or too large stars according to your eyepiece's field of view. Adjust Min and Max size options.



If you don't see anything on the screen after turning on this option, try to zoom in a little bit and move around different parts of the sky.

3.5 Geolocation and Time

System time is automatically updated according to your device's time but you have to put longitude and latitude information manually. Initially, these are set to 0 and you will see the red GPS icon on the top status icon location. Time and GPS information are important to properly draw the predicted sky.

3.6 Marker

As soon as you activate eFinder mode you will see a red mark on the image. The center of the red circle is where your main telescope is looking at. If it is the first time to use this feature with your telescope, you might need to move this marker to make it aligned with your telescope's view. Refers to [eFinder Align](#) for the detailed procedure.

3.7 Time Adjust

By default, the planetarium will show you the current sky. But you can draw the past and future sky by adjusting the time bar. The supported range is -10 to +10 hours to the current time.

3.8 Star Finder



Astroid has built-in NGC, IC, M, HIP star lists. To use the star finder, find the number of the star object that you are interested in and enter it to the search bar. It will show you its photo and other information as well.

Once you clicked a star on the star finder list, Astroid will display the location of the target and how many degrees you should rotate along the left/right and up/down direction. Adjust your mount according to this angle. Currently, the EQ mount guideline is not supported but this feature will be added in the future update.


3.9 AR Mode

As a default, when you drag the screen it will always move around AzAlt direction. But sometimes it is convenient to fix the screen view to the camera view and move the world instead. Enable the CameraView option in the setting menu, if you would like to enable this feature.

3.10 Click and Find


One of the most unique feature of Astroid is that you can click and find the star and DSO information from the camera's image. Combined with EAA stacker, Astroid provides visually interactive way to explorer the night sky rather than just selecting a star on a list.

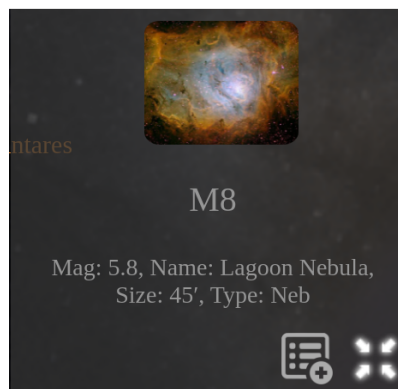
3.11 Camera Lock and Unlock


User interface automatically follows center of the camera image by default. If you would like to unlock the automatic camera follow mode, simply click the lock button on the left side .


Clicking the button one more time will switch it back to the lock mode and follow the camera.


3.12 Star List

You can make your own star list by clicking add button  in the star finder window.

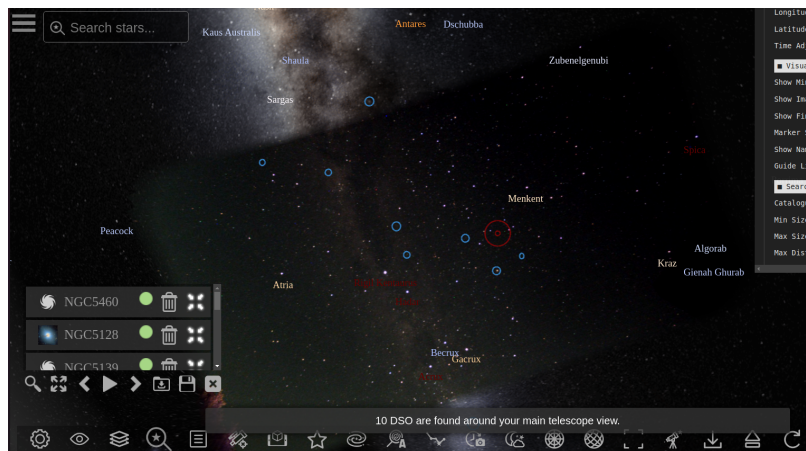



The added stars can be seen on the star list window. Click  to open the star list window.

Also, you can automatically search the nearby DSO to your current telescope and add it to the list by clicking  icon.

 Search nearby DSO. By default M is used but you can change it to NGC, IC in the Astro tools menu.

To save and load the star list use the following icons.



 Save list. The list is stored on Astroid's internal memory.

 Load list.

ARZOOM

ARZoom is one of the most interesting features of the Astroid system. This feature is often very useful when you would like to preview your telescope's view.

Follow the instructions below to use this feature.

1. Turn on the sky recognition and align Astroid to your main telescope.
2. Now, you should see the ARZoom window on the top right corner.
3. This is the view inside of your telescope's eyepiece.
4. Press +/- button according to your requirement.

ARzoom is currently supported up to 1 degree but we will increase the resolution in near future.

EAA STACKER

EAA stacker will assist you to easily stack images and make a great visualization of deep sky object either with your existing telescope or the basic sky recognition lens (5mm).

5.1 What is Image Stacking?

The raw images from an image sensor are usually quite noisy. One of the simplest ways to handle such noise is to take multiple images and getting an averaged image. EAA stacker supports multiple useful tools for image stacking.

5.2 Exposure Time and Gain

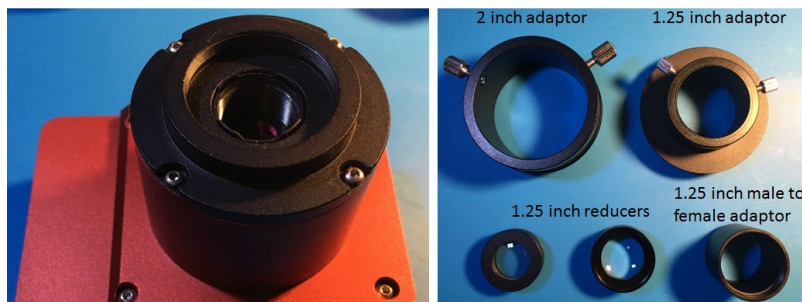
Exposure time and gain can be adjusted according to your preference. Short exposure time enables the EAA stacker to be more responsive to the mount movement and creates a less blurry image when used with a longer focal length lens. Long exposure can reduce image noise but it can cause unwanted star trails especially on manual and Altazimuth mounts.

Adjusting the gain to a higher value will amplify some faint signal such as nebular and make it more visible while it increases noises on the image. 160 or lower is recommended for the gain. When there is too much noise due to the high gain value, increasing the stacking image number will lower the overall noise level.

5.3 Installation Example

Astroid comes with a 50.0mm camera tube and 1.25-inch female thread for connectivity with the most common connection standards. The following example shows how you can use these two to mount Astroid to your telescope lens.

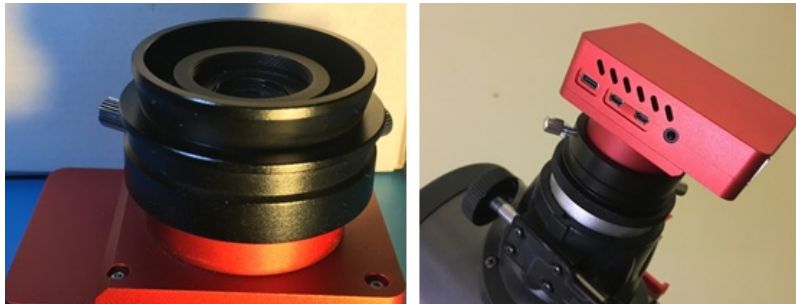
To use Astroid, the 5mm lens should be removed. The figure on the left shows standard telescope adaptors and lens that can be used with Astroid.



If your telescope only has a 1.25-inch eyepiece mount, use a 1.25-inch male-to-female adaptor to be able to mount Astroid on your telescope. The following shows an example configuration with Celestron's 1.25-inch adaptor.



In case your telescope has a 2-inch adaptor you do not need to separately buy a 1.25-inch tube instead you can directly insert Astroid into a 2-inch adaptor.



A bright DSLR lens such as Samyang(Rokinon) 85mm F1.4 or 135mm F2.0 lens also makes a great result with Astroid. Please note that mirrorless lenses such as the sony E-Mount lens are not suitable for Astroid due to the focal length. Canon EF mount lens is highly recommended.

5.4 Stack Mode

EAA Stacker supports two stack modes: with and without tracking. The tracking mode automatically aligns input images to the first image that was captured when the live stack mode was turned on. This is especially useful on a manual mount and an Altazimuth mount as the outcome looks like a static view. Turning off the tracking mode will be required when the lens is dark and the EAA stacker does not find a star to track. For example, any lens above F5 might cause frequent tracking reset due to a lack of trackable stars in the image. You can adjust the gain to make the stars are visible enough for tracking. You can also turn off the tracking mode will let the EAA stacker simply average images without alignment. Note that when the tracking option is off you must turn on the physical tracking option on your mount.

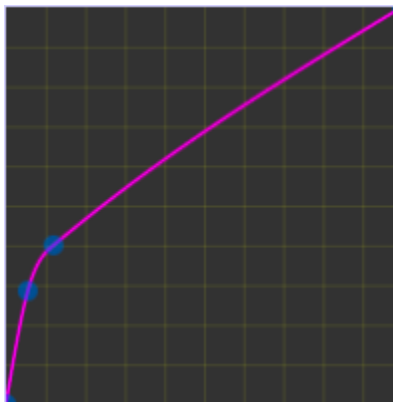


5.5 Mean Substraction

If the stacked image is too bright check this option. This option estimates the mean RGB value of the stacked image and subtracts it. Use this option if you are using EAA stacker under the sky with light pollution.

5.6 Tone Curve

EAA stacker provides a basic tone curve interface to effortlessly give a dramatic change to the raw image. Check the ToneCurve option in the control panel to show the tone curve and add multiple control points to adjust the curve. Typically to amplify the lower side signal the curve should sharply increase around the lower side and gradually on the high side like the following image.



To make such a tone curve you need to add two control points by clicking the curve line. Check the ApplyToneCurve option to apply the tone curve.

5.7 Stacking Number

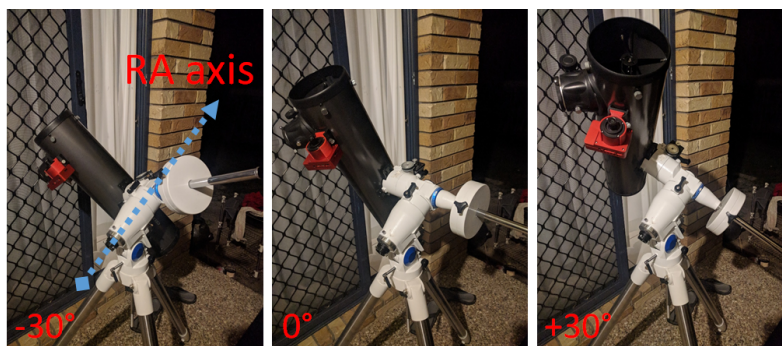
The number of images to be stacked can be adjusted through this option. The stacking numbers 4, 8, 16 add all the images on the buffer and divide by each stacking number whereas 32, 64 add without division for a darker lens.

DR. POLE

Dr. Pole let you do the EQ mount polar alignment effortlessly even when you do not see the pole star at all or the initial RA axis is pointing far away place from the pole star. This feature makes Astroid's polar alignment ability outstanding among the competition especially in the southern hemisphere (no bright star around the pole) or an urban environment (the pole star is often occluded).

6.1 Setup

You can do the polar alignment while Astroid is attached to the telescope lens instead of the RA axis. This means that if you adjust the DEC axis the camera will not see the same direction with the RA axis anymore but this is totally fine with Dr. Pole. This would be especially useful when the pole star is occluded. In such a situation, just rotate the DEC axis until Astroid can see stars like the following figure.



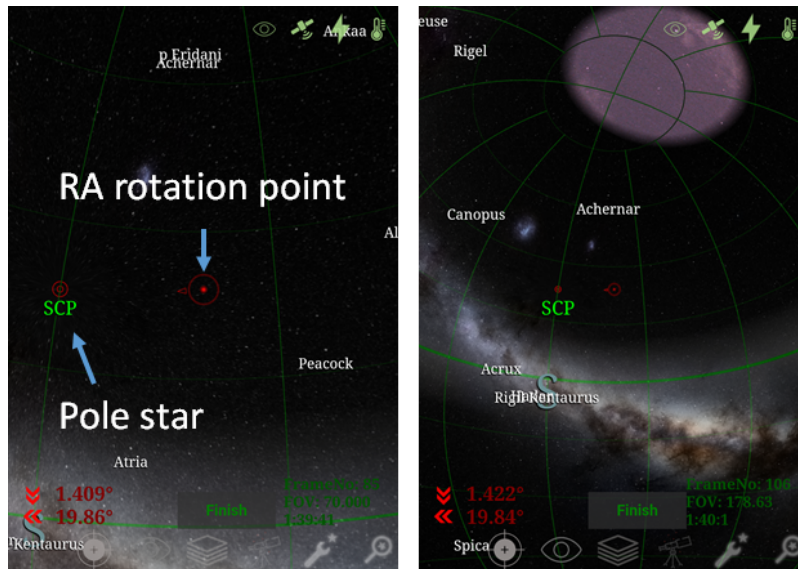
It is generally recommended to make a wider angle between the three RA positions but if it is not allowed in your place narrower angle works as well but with decreased accuracy.

6.2 Rotation Axis Finder

To start the polar alignment you have to find the RA rotation axis. RA rotation axis can simply be found by rotating the RA axis three times. Start the rotation axis finder by clicking the telescope icon on the bottom and follow the instruction on the screen.

Once the rotating axis is found you will see a guide arrow, pole star mark, and rotation center. The rotation center point is where your RA axis is rotating around. So, you need to move the point near to the north or south celestial pole according to your location by adjusting the mount base.

The rotation point mark is usually on the image of your RA axis and the camera is looking in the same direction. But if you used an off RA axis setup as described in the previous section, it could be anywhere like the right figure above.



Note that the DEC axis should not be moved at all times after the rotation axis is found. If it is moved by any chance, the axis finder should be started from the beginning.

You can also mount on the RA axis if you want more accuracy. This is due to the large telescope tubes sometimes being structurally distorted due to gravity which might affect the accuracy of the result a little bit.

LENS CALIBRATION

Lens calibration is important for accurate sky recognition and polar alignment. Astroid is initially calibrated at the factory but the calibration quality might degrade for various reason such as a strong shock caused by dropping the device.

If you feel eFinder alignment between the telescope and Astroid is not accurate, you can try to calibrate the lens using the lens calibration feature.

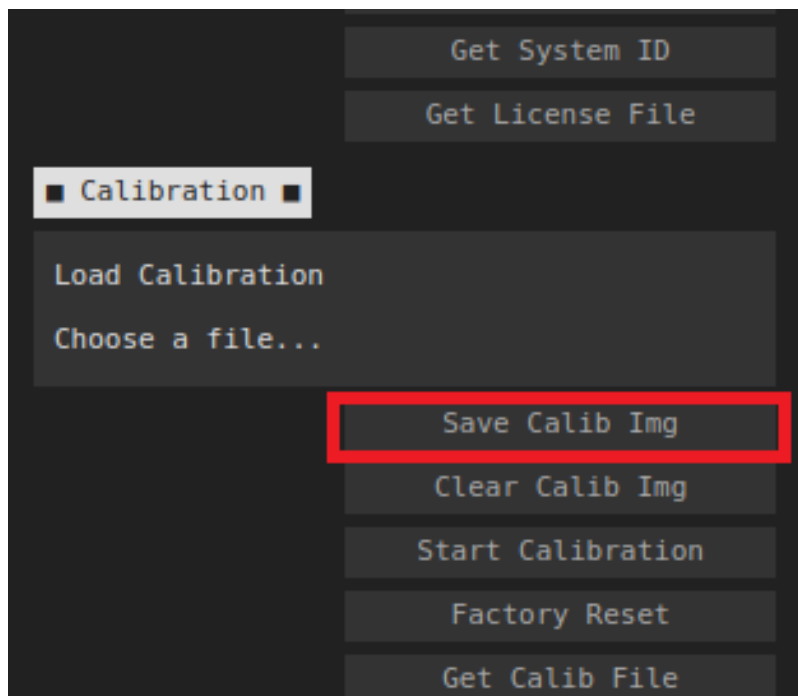
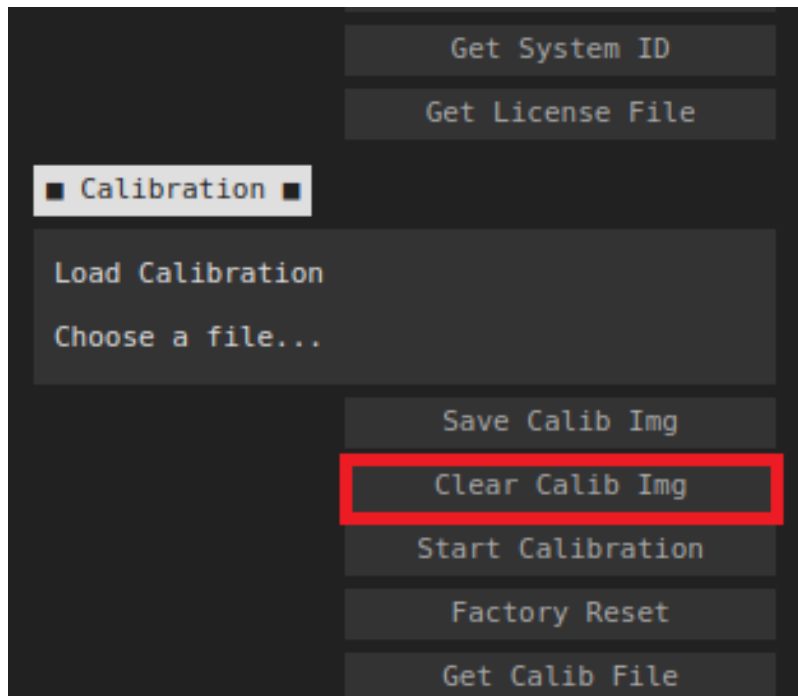
7.1 Requirements

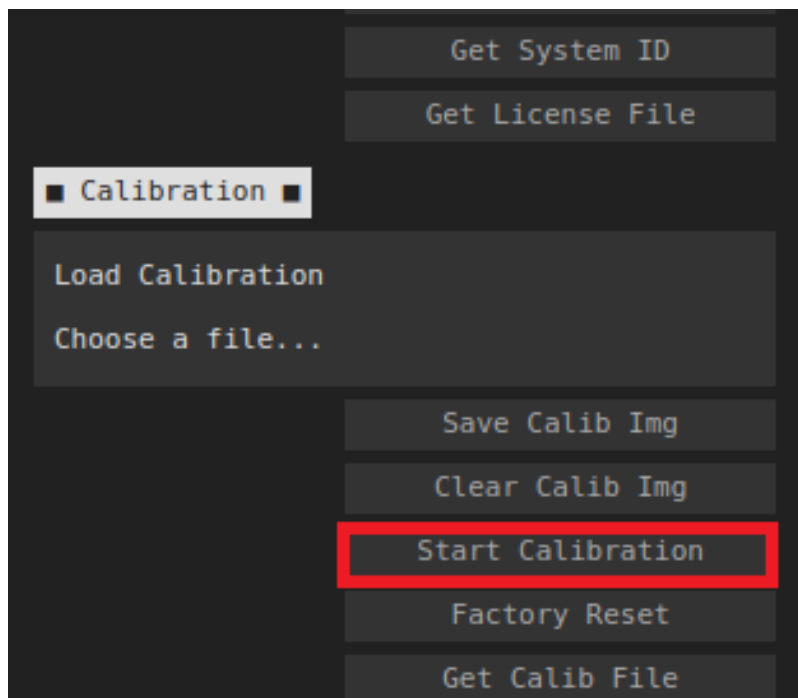
1. Clear and open sky
2. Sky without light pollution and Moonlight

The calibration is using the location of the stars in the image. Make sure you perform the calibration at a place where Astroid can see the stars well. It is possible to perform the calibration without such conditions but the quality of the calibration is not guaranteed.

7.2 Calibration procedure


1. Clear any prior calibration images by clicking “Clear Calib Img” under “System Setting”->”Calibration”.
2. Mount your Astroid on a tripod and adjust the tripod head so that Astroid’s lens points upward. The ball head tripod is the best for this purpose but you can just put the device on a table.
3. Wait until the sky is recognized.
4. Once the sky is recognized go to the setting menu and press “Save Calib Img” to store the image.
5. Rotate the camera about 20 degrees and repeat 3~4.
6. Take 20 pictures by repeating 3~5 and press “Start Calibration” button.
7. Wait until you see the calibration report message.
8. Realign the device to the telescope and see if the alignment is good.





TIMELAPSE

You can record the camera image to make a timelapse using this feature. Insert a DDS USB into the system and press

the timelapse icon  to start the recording. This feature can be used in two different ways.

1. Recording of your night sky explorations
2. Recording of EAA images of your main telescope

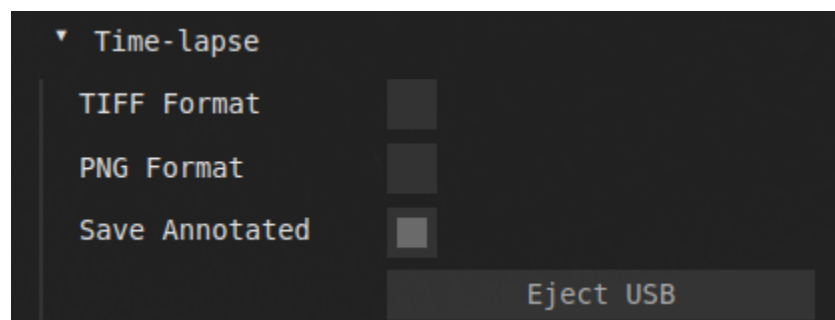
8.1 eFinder recording

When you use Astroid as a sky navigator, you can record the camera image stream along with additional information such as the sky recognition result, ARZoom view, RA/DEC, and time. To use this feature you must start the recording in eFinder mode.

Note that if you turn on the stacker or adjust the image stacker setting, the final result after image processing will be stored. This will let you easily record night sky timelapse with the Milkyway.

8.2 EAA image recording

This mode is useful when you would like to record the EAA result. Make sure to change the save image format to TIFF or PNG in the timelapse setting menu before you start the recording as “Save Annotated” is the default.



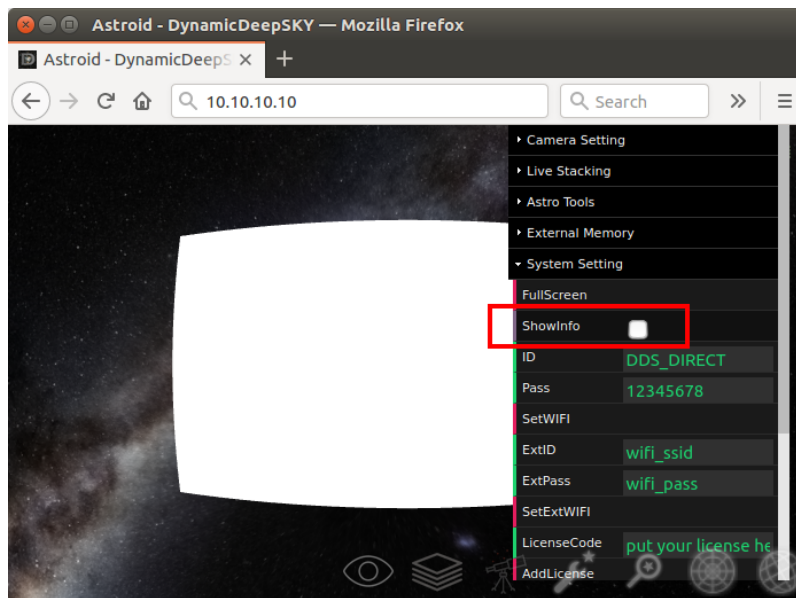
COLLIMATION

Under construction



SYSTEM UPDATE

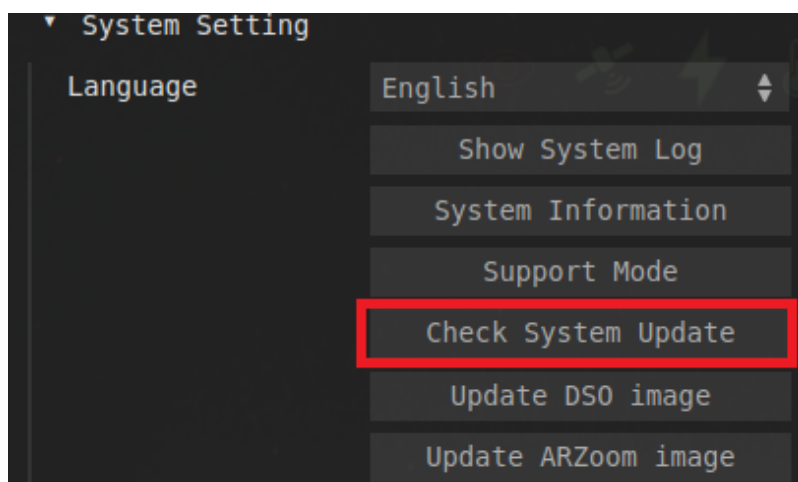
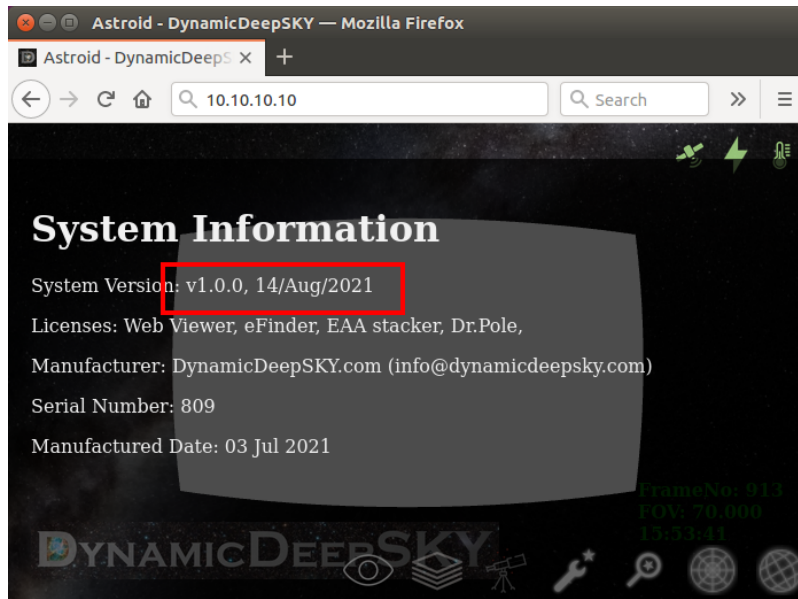
10.1 Checking Your System Version

Go to system setting and click “System info” to open the system information window. If your system version is older than the version on our homepage, you can update your system.





10.2 System Online Update

1. Connect your device to the internet either by ethernet cable or external WIFI. If you registered your email or phone number in the system setting menu, you will receive the IP address of the device as a message.
2. Open the web interface and go to the setting menu -> “System Setting” and click “Check system update”. If there is a new version, the system update will be automatically started and you will see the USB icons  on the top side. You can see the progress in the system log. To see the system log, click “Show System Log” under the “System Setting” menu.
4. Wait until the update icon  disappear
5. Reboot the system



6. Check if the system version is up to date.

10.3 System Offline Update

1. Download an update file from DynamicDeepSKY.com. The update files are under the support tab.
2. Copy the downloaded file to DDS USB. If you don't have the DDS USB, see [Making a DDS USB](#) for more information
3. Insert the USB to Astroid. You will see the USB icons  on the top side.
4. Wait until the update icon  disappears
5. Reboot the system
6. Check if the system version is up to date.

MAKING A REMOTE SYSTEM

You can turn your telescope into a powerful remote observatory.

1. Connect Astroid to the home WIFI
2. Forward the port number 80 to Astroid in you router setting page. The router's setting page is usually 192.168.0.1. Talk to your internet service provider if you need help regarding the router setting.
3. Type your static IP address in the internet browser to see your Astroid page. Now, anyone on earth who knows your IP can access to your Astroid.

TROUBLESHOOTING

12.1 General Problems

DDS_DIRECT does not appear

- Cut the power and reconnect
- Turn on/off your device's wifi a couple of times
- Connect HDMI to a monitor and see if OS is running. If OS is running and the wifi icon on the top-right corner is showing 'Could not communicate with wpa_supplicant', your WiFi setup is broken. This is currently an issue with V1.0.0.

You have two options.

1. If you don't have the HDMI cable and can't see if it is your case, simply running the system recovery will solve the problem.
2. If you already confirmed the problem, open the commandline window and type the following two commands.

Wifi reactivation commands:

```
sudo systemctl enable dhcpcd
sudo service dhcpcd restart
```

- Reassemble the housing - wifi signal related problem might disappear

(Android) DDS_DIRECT does appear but nothing pop-out when I browse to 10.10.10.10

This can happen the connection between your phone and DDS device hasn't been properly established because DDS_DIRECT has no Internet access (This is Android system's issue rather than DDS). The following steps describe how to properly establish the connection.

First, connect to DDS_DIRECT with the default password as shown

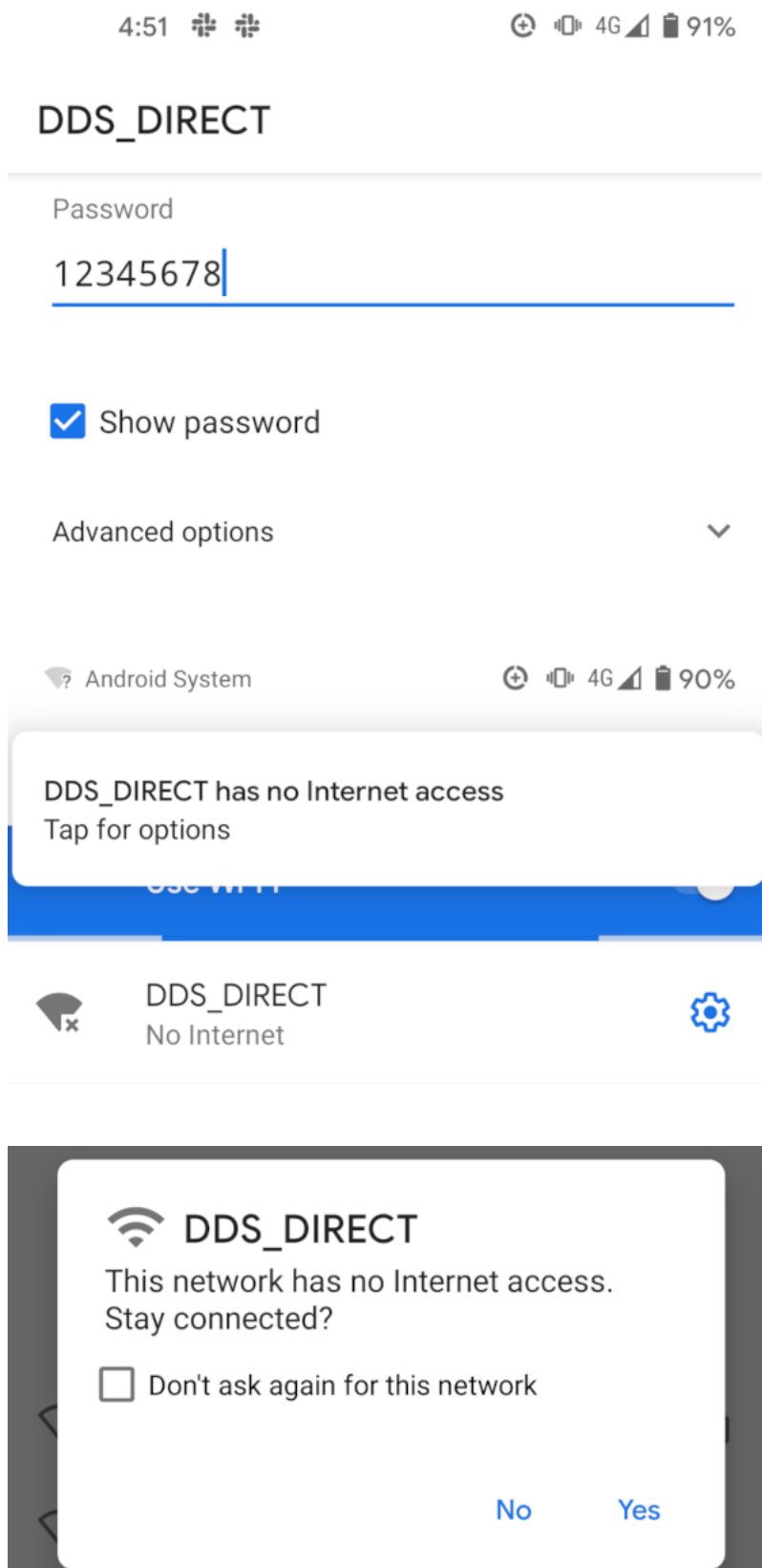
There will be a notification informing that DDS_DIRECT has no Internet access.

Press "Tap for options" and there will be a pop-up asking if stay connected? Select "Yes". You then established the connection.

If the connection is correctly established, you should be able to find a small wifi icon with a questionmark beside at the top of your screen.

Video is too slow or there are severe lags

- Try to get closer to the device.
- Try other USB cable



- Try other power source

Not able to connect

- Cut the power and reconnect
- Turn off and on the device's WiFi a couple of times
- Try the system recovery

DDS_DIRECT is connected but astroid.local is not found

This occasionally happens especailly when you run the system for long time (at least a couple of hours). It is simply the host name astroid is not visible.

- Most of the time, rebooting the system solve this problem.
- If you are connected through DDS_DIRECT, try 10.10.10.10 instead of astroid.local. If Astroid is connected to a router, go to router setting page and find the list of the connected devices. Find the IP address of your Astroid and use that IP to access the Astroid web interface.
- Try the system recovery
- This might be a camera problem especially if you drop the device while the lens is fitted. Contact us for more information.

RPi is dead. No monitor signal. No power light. No reading light

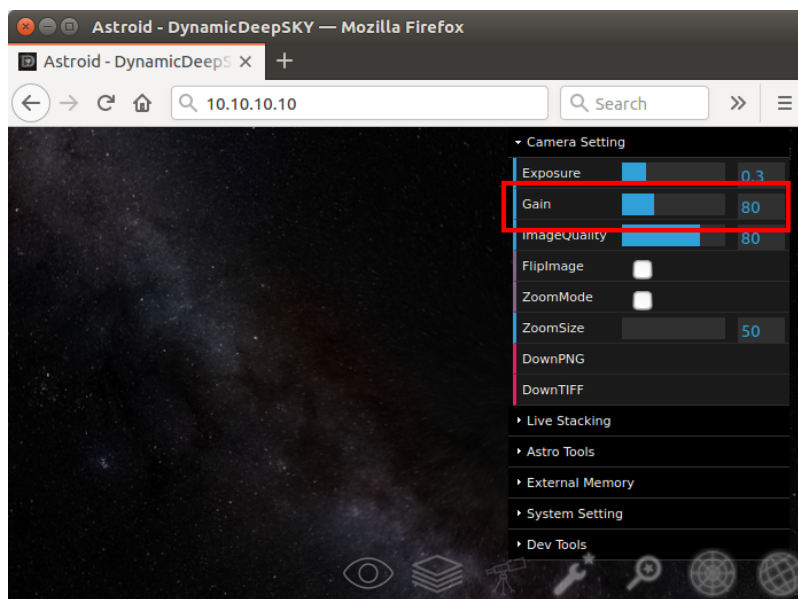
You have two options. If you are good at DIY, you can get a new RPi4 2GB model and fit that in. You just need to get a new license codes from us. Just get us your serial number, your name and we will issue a new license for you.

The second otpion is sending your Astroid to us. But you need to pay the shipping if the warrenty has over.

12.2 eFinder Problems

Sky recognition is too slow or not working

- Normally the sky recognition takes 0.1~5 seconds
- Adjust the Gain a bit higher or lower



- Point the camera to a direction where no cloud, moon, building exists
- Check your lens focus
- Try other USB cable
- Try other power source
- Check if your license is properly appear on the system info window. If not register it again. Let us know if don't know your eFinder License code.
- Run the lens calibration
- Check the thermal grease is properly spread (DIY kit only)

Color balance looks incorrect The color balance of Astroid is fixed to natural light condition. If you have some light source it might show an unbalanced color.

12.3 EAA Stacker Problems

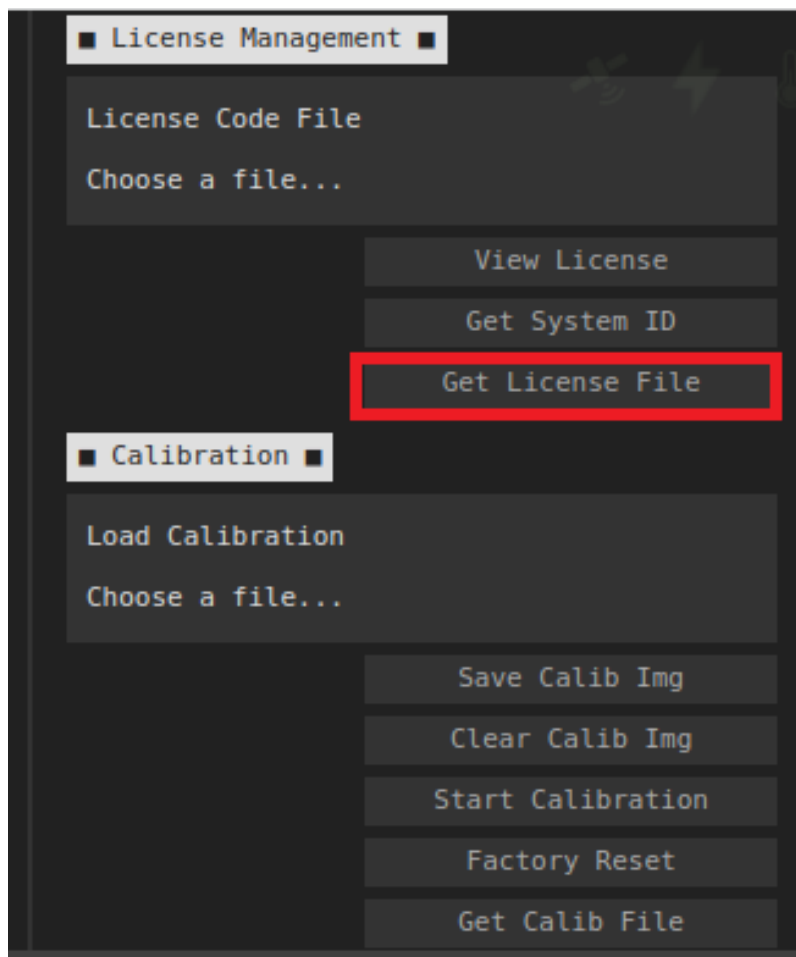
Tone curve adjust is not working on a mobile device This is a bug. It will be fixed in the next update.

12.4 Dr. Pole Problems

RECOVERY INSTRUCTION

Before you start the recovery process you have to backup your license and calibration files.

1. Download your license file

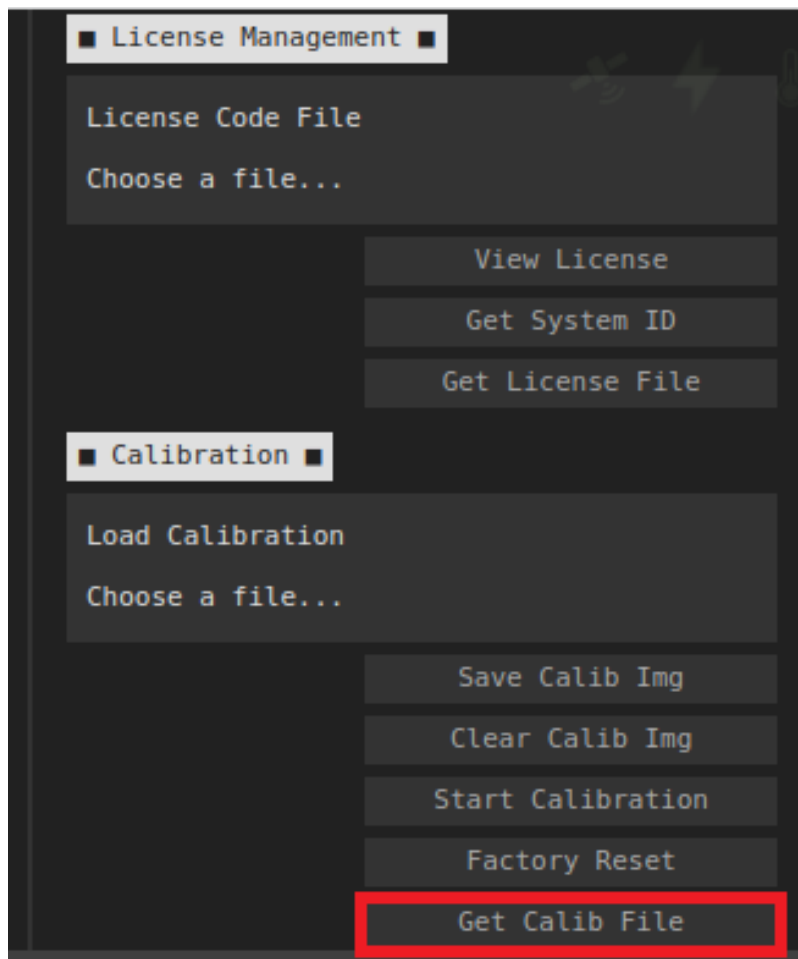


2. Download your lens calibration file

If your device does not boot and cannot download these files please contact us at info@dynamicdeepsky.com. We will send you those files as soon as possible.

Follow the steps below to recover your device to the factory setup.

1. Download the Astroid OS image from dynamicdeepsky.com under the support page



2. Download the Raspberry pi imager from <https://www.raspberrypi.org/software/>
3. Pull out the OS SD card from Astroid and mount it to your computer either by SD card USB adaptor or built-in sd card reader.
4. Burn your SD card with the downloaded image.
5. Put it back to Astroid and connect the power.
6. Wait for 5~10 minutes until you see “RPiHotspot” in the WIFI list.

Important

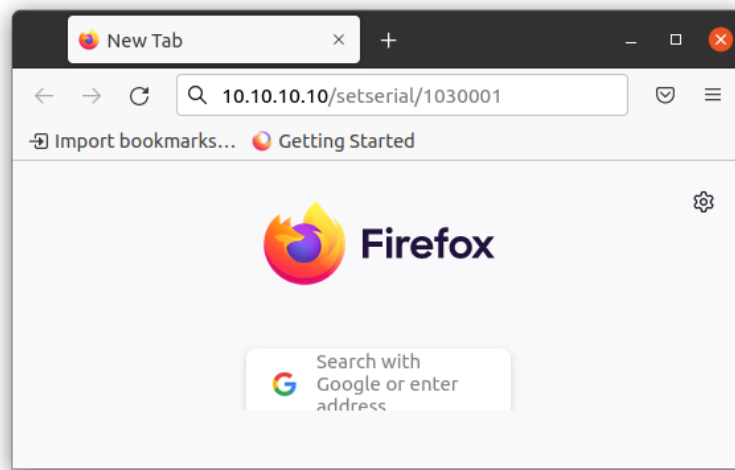
If you cut the power before you see “RPiHotspot”, you have to start from 3 again.

7. Connect to RPiHotspot and set your serial by entering the following into the web browser:

http://10.10.10.10/setserial/YOUR_SERIALNUMBER

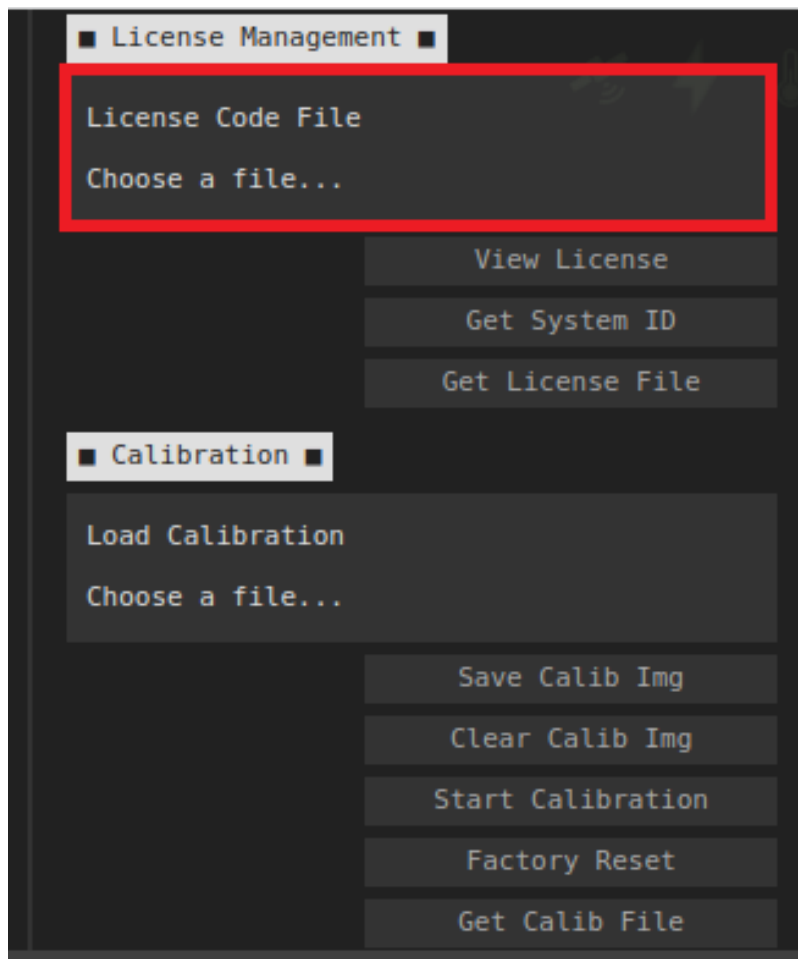
For example, if your serial number is 1030001 use the following command.

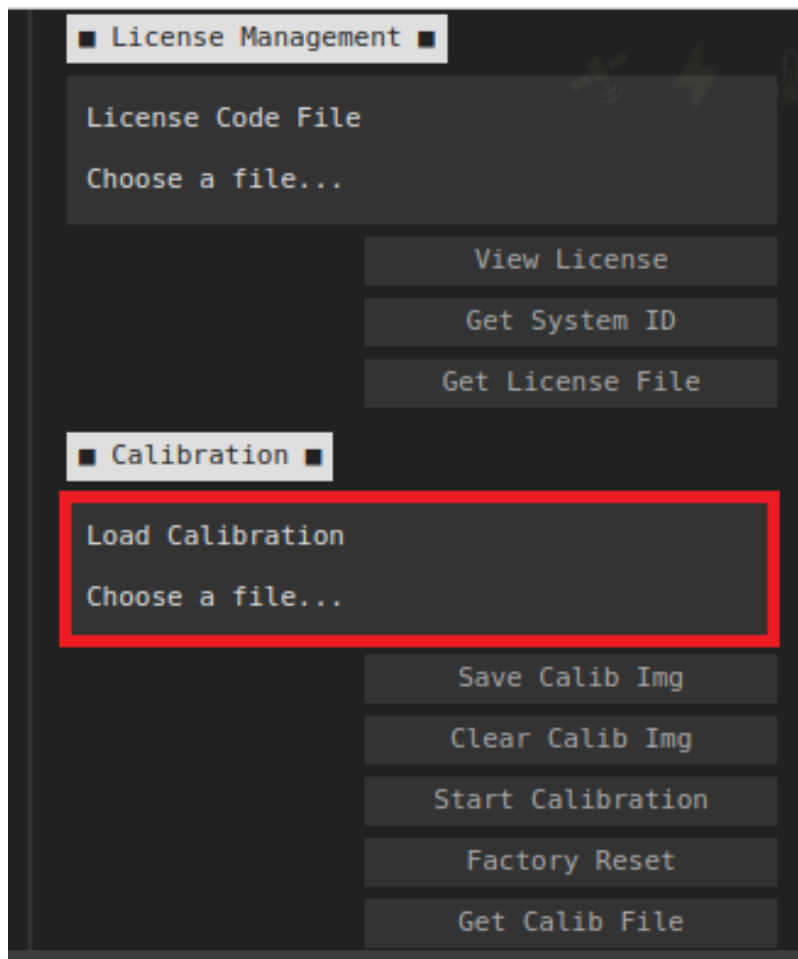
<http://10.10.10.10/setserial/1030001>



Once you enter the serial number your device’s WIFI ID will be changed to DDS_DIRECT_1030001

8. Now, you need to set up your license and serial. Click the “License Code File” button under “System Setting”->“License Management” and select the file you downloaded before the reset.
9. Click the “Load Calibration” button under “System Setting”->“Calibration” and select the file you downloaded before the reset.
10. Check the system version on the ShowInfo window and run update if it is outdated. See [System Update](#) for more information





KNOWN ISSUES V1.1.0

UPDATES LOG

15.1 v1.1.0 3/06/2022

First official release

15.2 v1.0.0 13/08/2021

Initial beta release