User Manual - Nexus eFinder

Introduction

The Nexus eFinder complements the encoder-based positioning of the Nexus DSC Pro. The encoders provide a fast and responsive position even with the scope moving. However, due to mount and alignment errors this position can be out by quite a few arc minutes. The Nexus eFinder uses plate-solving to give the Nexus DSC Pro a real sky position fix when needed. The primary use is to sync at a target, where previously the observer had to move to a nearby bright star to sync and back again. Now this is done without the need to move the scope away from the target area, saving time and increasing accuracy. If goto drives are fitted then this sync can be automatic and part of the goto process (aka Goto++), producing goto accuracies of less than an arc minute with respect to true sky RA & Dec, (dependent on drive backlash).
The Nexus eFinder also simplifies the initial Nexus DSC Pro 2 star align process.

Setting up

Mounting

Attach the eFinder to the telescope, ideally fitting to a standard finder shoe. The eFinder does not need precise mechanical alignment with the telescope but ensure it is within a degree or two. Check the eFinder and its mounting is secure and does not flex unduly.

Electrical Connection

Make sure the Nexus DSC Pro firmware is version 1.4.12 or later.
Before plugging the eFinder into the Nexus DSC Pro usb port, set the Nexus DSC usb protocol to 'Electronic Finder' 9600, 8,1,N.
Ensure the Nexus DSC Pro align method is one of 1-star, 2-star w/o AltRef, or 3-star align. 2-star w/o AltRef is recommended.
It may be useful to enable sound effects on the Nexus DSC Pro.
Turn the Nexus off and connect the eFinder.
The eFinder draws its power from the usb port and hence will increase the drain on the Nexus DSC Pro battery. About 4 hours runtime may be expected, or the user can connect an external power source to the Nexus DSC Pro.

Starting a session

Powering Up & Connecting

Turn on the Nexus DSC Pro. The eFinder LED will illuminate at a fairly bright level. It will stay steady for about 15 seconds while the eFinder processor boots, then it will blink at 1Hz for a further 15 seconds or so while the eFinder code and index files are loaded. When ready the LED will dim to a steady level set that can be set by the user. During this boot sequence the Nexus DSC Pro will play various chimes as it recognises the boot progress.

WIFI

The Nexus eFinder will initially try to connect to the infrastructure WIFI router used to build the sdCard. This may be suitable for some users.

Alternatively, the Nexus eFInder can generate its own WIFI Access Point (AP), aka Hotspot, to which devices can connect. Navigate to the Electronic Finder/Settings screen and change mode to Access Point. After a few seconds the Nexus eFinder will create an AP with a ssid 'efinder**** ' and the same password as the Nexus DSC Pro AP WIFI.

Settings

Focus

At first use, the camera will need focusing. If the Arducam 25mm f1.2 lens has been used, then as a first approximation turn the focus ring until a gap of about 1.5mm is left between focus ring and the ridge on the main lens housing.

Now connect a pc or tablet to the eFinder WIFI and browse to efinder.local (or whatever you set the hostname to when building the sdCard). At very first boot you should see a blank screen with a question mark at top left, thereafter a picture of the last saved image.

Navigate to the Electronic Finder/Focus Assistant screen on the Nexus DSC Pro. The eFinder will take an image and try to analyse it. The image will also appear on your web browser. You can adjust focus, exposure and gain to obtain a clear image of either stars (at night) or a distant object (during the day). Toggle exposure up & down to grab a new image. When done tighten the focus locking screw on the eFinder lens.

If done during the day, be sure to reset the gain to 20 and exposure to 0.2 before turning off the Nexus DSC pro. It is advisable to repeat this process on stars to obtain best focus.

When a star field has been imaged using the Focus Assistant screen, and it is close to optimum focus, the screen will show a thumbnail image of the brightest star, a PSF intensity plot (Point Spread Function), number of candidate stars found and the peak signal. The next section describes how to use this screen to set optimise settings.

Exposure & Gain

On a typical sky a gain of 20 and exposure 0.2 will give consistent solve results all night and for all sessions. On bad washed-out skies this might need to be increased to 30 and 0.4 or so. Most users will find a setting that works 95% of the time for their particular site.

The Focus Assistant screen can provide help in adjusting the exposure and gain. The solver needs at least 20 stars to achieve a solve but beware of overloading with a peak signal at or near 255 as this can affect Offset Calibration. See below.

Observing

Offset Calibration

First step is to calibrate the offset between the Nexus eFinder and the main telescope. Navigate to the Electronic Finder/Offset screen.

Point the telescope as accurately as possible at a fairly bright star. Polaris is ideal in the northern hemisphere as it is stationary. Press OK on the Nexus DSC Pro.

After a short while the screen should show the solve result, including the offset in degrees. That offset will be saved until another offset calibration is done. However it is recommended that this calibration is done at the start of each session.

If the screen shows either a failed solve, or the wrong star, then focus, exposure or gain may need adjusting. Go to the Focus Assistant screen and check to see the current results and make adjustments.

Guidance:
If the wrong star is being found then either the eFinder is not pointing where the main scope is, or the exposure is too high. Oversaturated and bloated star images can be ignored by the plate-solver. Try reducing the exposure time or gain. Do not try to Offset calibrate on very bright stars such as Vega. Polaris is a good typical target at magnitude 2 as this is more typical of general stars that will later be solved in Align and Local Sync observing.

If it failed to solve, then increase exposure and/or gain. A look at the PSF should give an indication of the strength of star images.

Nexus DSC Pro Align

Navigate to the Electronic Finder/Align screen. Point the scope at a clear part of the sky at an elevation of about 45 degrees. Press OK. Move the scope at least 60 degrees in azimuth to another clear part of sky and press OK. You should get an align successful message. That's it!

You can now navigate away from the Electronic Finder screens to the main Nexus DSC Pro menu to continue observing.

eFinder Sync

After pushing to a target or using a drive goto, the target will in general not be centred in the eyepiece. This is mostly due to mount errors. Previously a sync involved moving off to the nearest Named Star and accurately centring that in the eyepiece and syncing. Then moving back to the target. This takes time and does not completely remove the errors.

With the Nexus eFinder the sync can be done without moving the scope away from the target area. With the target selected in the Nexus DSC Pro, press the left arrow button and then select '6' for EF SYNC.

The Nexus eFinder will take an image and plate-solve allowing the Nexus DSC Pro to correct its position. The 'distance to target' will adjust accordingly. The observer can now push the scope according to the new numbers, or if driven repeat the goto.

Goto++

To be implemented soon. For now, manually do a Local Sync and a repeat goto (as described above)

Live Mode

Introduction

In Live mode, the Nexus DSC Pro is not used and the eFinder can be powered from any 5V USB supply. The eFinder enters a continuous loop trying to image and solve as fast as possible. The result is broadcast over WIFI to SkySafari.

The mode is accessed by pressing and holding the switch during the power up sequence. Specifically, it needs to be pressed at the transition between steady and blinking LED. The LED then blinks at 4Hz until the boot is completed.

The WIFI mode can be changed between Infrastructure and Access Point (AP) by a short press to the switch after the boot has finished. The LED blinks rapidly while the mode is changed.

SkySafari Settings

Telescope type:	AltAz Goto, Meade LX200 GPS/ACF
Refresh rate:	2 per second
Port:	4060
IP address:	Infrastructure mode – as assigned by your router AP mode – 10.42.0.1

eFinder Control

The telescope control panel in SkySafari is used to control the eFinder.

Button	Function
Align	Calibrates scope to eFinder Offset.
Slew Rate Slider	Sets exposure & gain to suit sky conditions. From left to right Excellent – Good – Bad - Ugly
Move scope up arrow	Increase exposure by 0.1 sec
Move scope down arrow	Decrease exposure by 0.1 sec
Move scope right arrow	Start saving eFinder image (will cancel after 100 frames)
Move scope leftarrow	Stops saving eFinder images immediately

The saved image can be viewed by browsing to efinder.local (or your chosen hostname) over WIFI.