LEADERS THROUGH INNOVATION
STARLIGHT XPRESS ltd

Handbook for the SX 'Lodestar PRO' guide Camera

Thank you for purchasing a Starlight Xpress 'Lodestar PRO' guide camera. We hope that you will be very pleased with the performance of this product.

The Lodestar PRO is an updated version of the very popular 'Lodestar X2'. It is a very compact guider which is powered and operated via a single USB2.0 computer connection. It also provides an opto-isolated output connection for direct control of most mounts, via their 'Autoguider' sockets. This output is compatible with the 'ST4' style of RJ12 connection and supplies 4 'pull down' direction lines and a common return. Alternatively, you may send the mount control signals via a serial connection from the guider control computer. The Lodestar PRO utilises a very sensitive Sony 'ExView2' CCD (the ICX829AL) with an array of 752 x 580 pixels in a 'half-inch' format sensor. Although the chip is not cooled, it has a very low dark signal and very little readout noise, so it can be used to guide on faint stars that are well beyond the reach of webcams and CMOS chip based guide cameras.

The Lodestar PRO specification:

CCD	-	Sony ICX829AL ExView2 monochrome CCD
Pixel count	-	752(H) x 580(V)
Pixel size	-	8.6 x 8.3uM
Optical size	-	6.47 x 4.81 mm
Read noise	-	Typically 5.5 electrons
Gain	-	0.75 e/ADU
Barrel size	-	31.75mm dia. x 85mm long (1.25 inch eyepiece push fit size)
Barrel thread	-	25.4mm x 0.75mm 'CS' mount lens thread
Input connection	-	'Mini B' USB socket for USB2.0
Output connection	-	Standard RJ12 autoguider socket
Output type	-	Opto-isolated 4 lines (N,S,E & W) pull down with common return line
Download rate	-	Approx. 10 frames per second in binned 2x2 mode (recommended)

Installing the Lodestar PRO:

Before connecting the Lodestar PRO to your computer, please install the appropriate drivers for your operating system from the USB drive supplied with your camera.

The supplied USB stick contains all the drivers and software. To install the drivers:

1. Select the folder for your operating system
2. Double click on the "Install Drivers.exe"
3. Follow the prompts in the installer and click 'Finish' at the end of the install.

If you encounter any problems, read the README file on the USB drive or you can download the latest drivers from our web page at https://www.sxccd.com/drivers-downloads.

The Lodestar PRO control software is Lodestar X2.exe. To install this:

1. Double click on the Lodestar Software folder on the USB drive.
2. Double click on the Setup.exe program
3. Follow the prompts to fully install the software on to your computer.
4. Plug in your Lodestar PRO camera – (Wait for the Install New Hardware Wizard to complete)
5. Double click on the Lodestar X2.exe icon on your Desktop or from your START button on your computer.
6. The first time you use the software, click on "File" then "Set Program Defaults" You will get a message, "Warning – No INI File found – Please set defaults"
7. Click "OK" – The Set Program Defaults box will appear.
8. If you are going to be using the RJ12 Autoguider Port on your Lodestar PRO, select Autoguider Socket in the "Telescope Guiding Parameters" box at the top of this box.
9. Click on "Save Changes" and you are all set to start using the camera. (The INI file that was being asked for initially has now been created and you will no longer see the Warning message)

To install Starlight Live ('Live-stacking') software:

1. Double click on the Starlight Live folder on the USB drive.
2. Double click on the Setup.exe program
3. Follow the prompts to fully install the software on to your computer.
4. Plug in your Lodestar PRO camera – (Wait for the Install New Hardware Wizard to complete)
5. Double click on the Starlight Live.exe icon on your Desktop or from your START button on your computer.

PHD2 is also supplied on the USB stick. This is an excellent and very simple stand-alone Autoguiding Software. We would highly recommend trying this software as it is highly regarded in the Astro-Imaging community.

Other 3rd party software packages such as AstroArt, MaximDL, SkyX and others, all support the Lodestar PRO either with native drivers or through ASCOM. Our latest driver can be found on our website: https://www.sxccd.com/support/resources

Using the Lodestar PRO:

The Lodestar PRO is generally used with a separate guide telescope, or via an off-axis guider. It is designed to be inserted into a standard 1.25" focuser assembly, but also has a 25mm 'C' type camera lens thread in the front to allow standard CCTV lenses or adaptors to be attached. Please note that the chip to lens distance is only 12.5mm and so a 'CS' to 'C' extension will be needed to permit a standard C lens to reach focus. Lenses designed for 'CS' mount cameras will focus without an extension tube, but many of these lenses cannot fully illuminate a half-inch format CCD, so take care when selecting a lens for this purpose.

A typical set up might consist of an inexpensive 80mm F5 refractor 'piggybacked' onto an SCT, with the Lodestar PRO fitted directly into its focus barrel. Many such telescopes are designed to be used with an inverting prism ahead of the eyepiece and so the focuser may be too short when the Lodestar PRO is inserted directly. In this case, an extension tube may often be made from a cheap Barlow lens assembly with the lens removed.

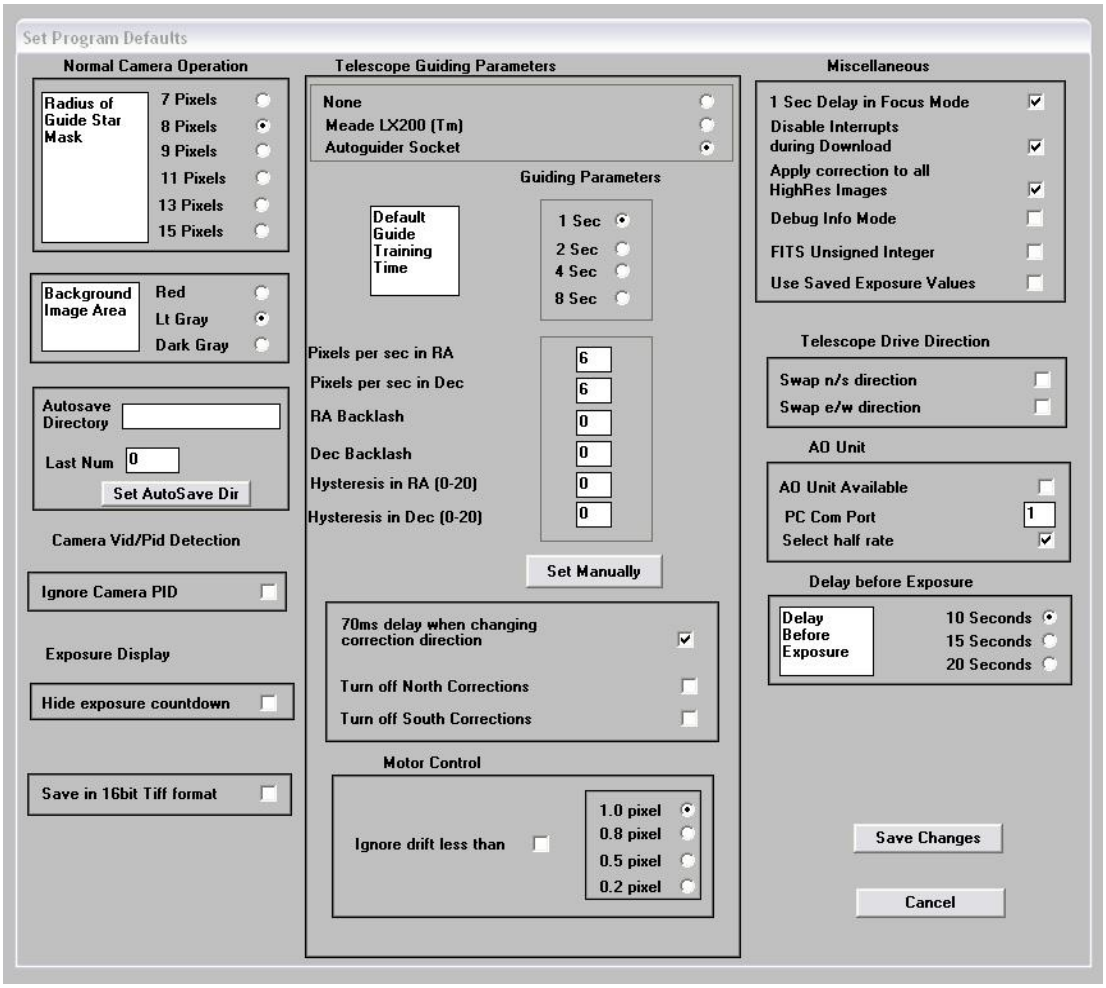
The focal length of your guide telescope is not especially critical for good guiding, as the guiding software searches for the 'centroid' of the guide star image and can resolve shifts of far less than 1 pixel. Using a guide scope with a relatively short focal length (between 300 and 500mm) makes guide star finding very easy and this is a recommended setup for general purpose guiding.

The control of your telescope mount will depend on what inputs are provided. The Lodestar PRO output connector supplies 4 pull-down lines and a common return line to simulate an 'ST4' style autoguider output. The lines are isolated from the Lodestar PRO electronics by opto-isolator chips and so there is no risk of damage when connecting the outputs to mounts with unprotected electronics. A standard 'RJ12' style output lead is supplied with the Lodestar PRO and this may be connected to any ST4 compatible autoguider input socket on the mount. It is also possible to guide by using serial data from the computer to an RS232 input on the mount, but this will be covered later and can be less effective than the direct hardware connection.

The preferred guiding mode is 2x2 binned, as this gives both fast downloads and high sensitivity without any 'interlacing' issues. The 'Fast' 2x1 mode is also useful if you are working with a short focal length guide 'scope, as it offers somewhat finer RA guiding resolution in the X axis if this is oriented East-West. If operating with a very short focus 'scope, high resolution mode may be best.

Guiding with the Starlight Xpress software

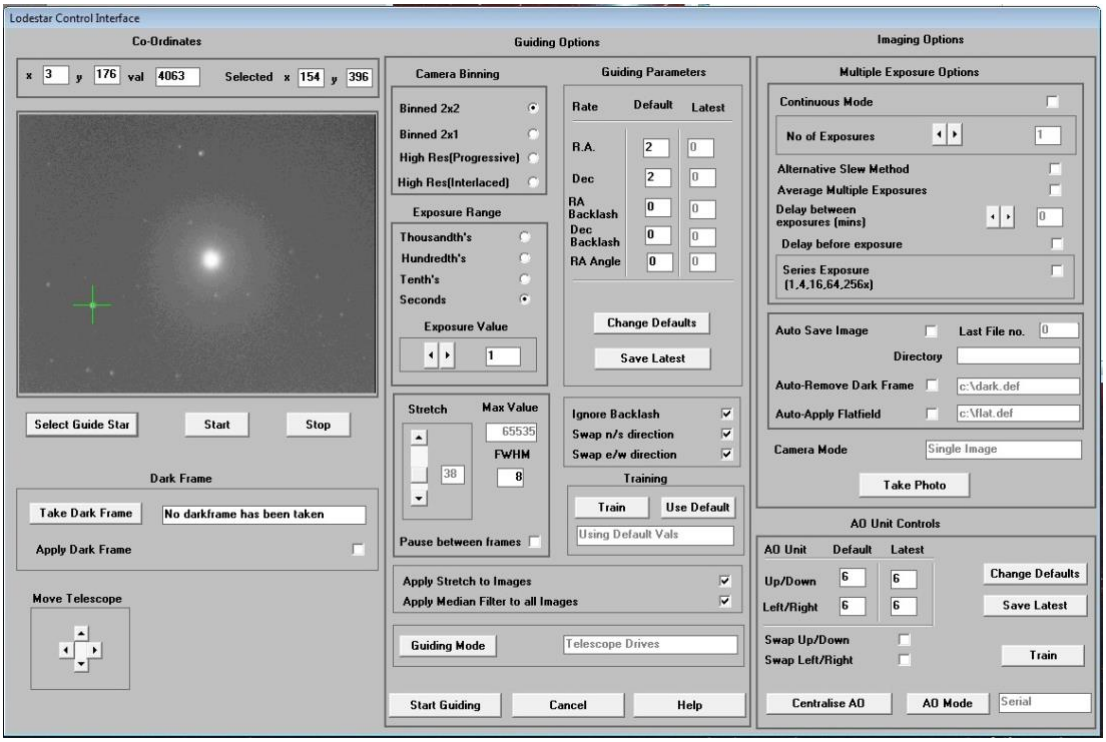
With the Lodestar PRO connected to the PC and mount, open 'Lodestar X2.exe' and find the 'Set program defaults' menu under the 'File' heading. If this is the first run of the software, you will get a warning about the 'ini file not found', but ignore this and click on OK. You should now see a screen similar to the one shown below:



The settings shown above are generally satisfactory as a starting point, although some will probably need refinement for best results. In the example shown, the 'autoguider socket' on the Lodestar PRO is providing the control signals to the mount, but you might alternatively use the 'LX200' mode via the serial port of the computer, if this is preferred. The Guiding Parameters are set to 6 pixels per second, which corresponds to the typical drift rate of a 1000mm focal length guide telescope when the mount is guiding at 0.5x sidereal speed. Longer focal lengths and/or higher guiding rates will require a larger value to be set so as to avoid excessively fast corrections, which can cause erratic guiding or even oscillation of the guiding errors to either side of the guide star.

Once the defaults have been set to values which you think will be approximately correct, save the settings and open the 'View' menu. In this you will see an option called 'Max palette stretch'. Open this and check the 'Activate stretch display' check box. This will automatically boost the image brightness so that faint guide stars can be easily seen – if necessary, you can adjust the slider for the best results.

Now click on the camera icon to open the Lodestar PRO control dialog, as below:

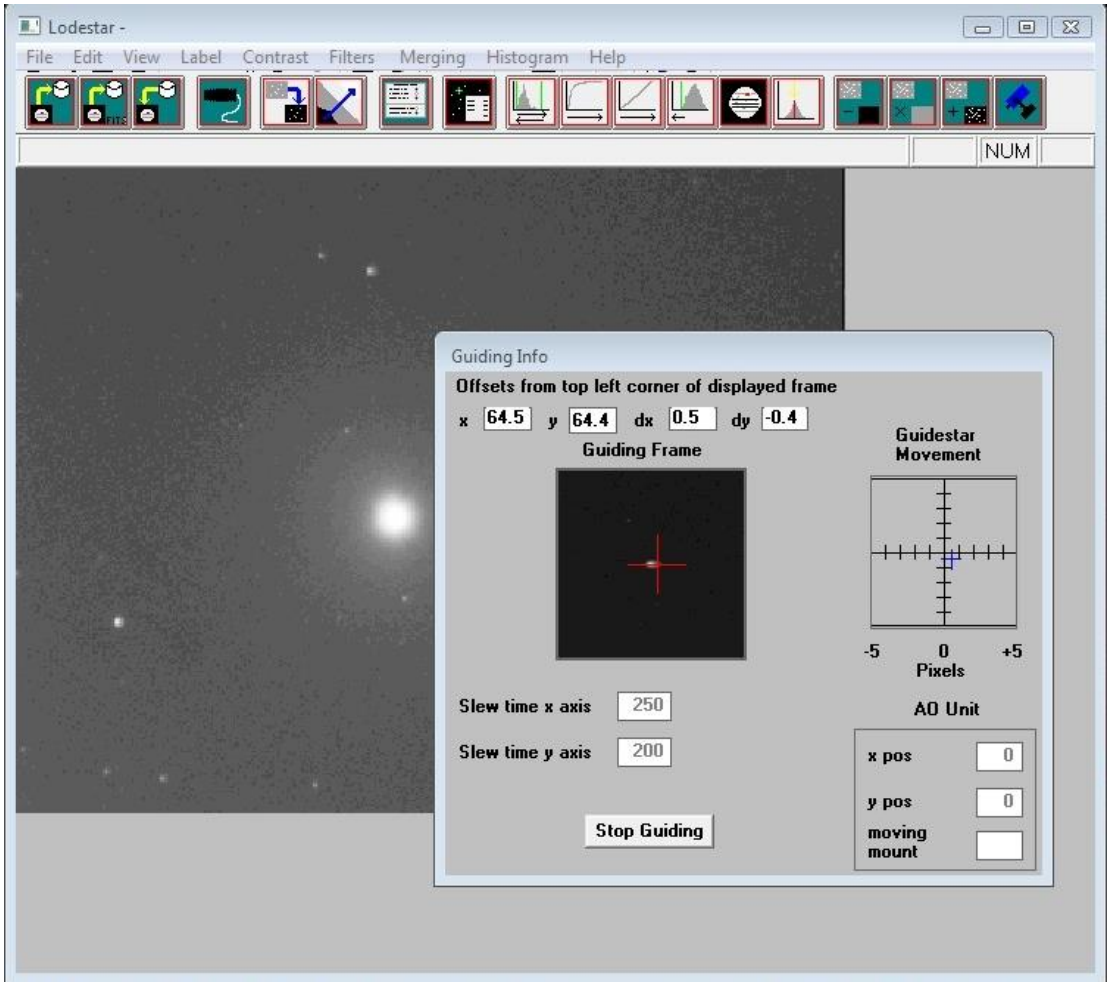


The image box will be empty at this point, but we need a frame to select the guide star from, so use the guiding options to select a suitable exposure time (say 1 second) and press the ‘Start’ button below the image box. A sequence of images will be shown and you can refine the image focus and centring as required. Before attempting to guide, it is wise to check that you have control of the telescope drive via the Lodestar PRO software. This is easily done by pressing the ‘Move Telescope’ buttons at the lower left of the control box. Check that pressing the arrow buttons causes the star field to drift left, right, up and down, as appropriate. The LED at the back of the Lodestar PRO should change colour when the buttons are pressed. If all is well, move onto the next step below:

Once a good guide star has been found, press the ‘Stop’ button and then the ‘Select guide star’ button. You can now click the mouse arrow on the guide star and a green cross will appear, centred on the star (see above). Don’t select a very bright guide star, as this will result in poor guiding due to saturation of the core pixels in the star image. The example above shows the region around Vega and it is clear that Vega itself would make a very poor guide star due to its large saturated core.

Once the guide star is selected, a small box appears with the star coordinates. If they look good, just click on OK.

Now click on ‘Start Guiding’:

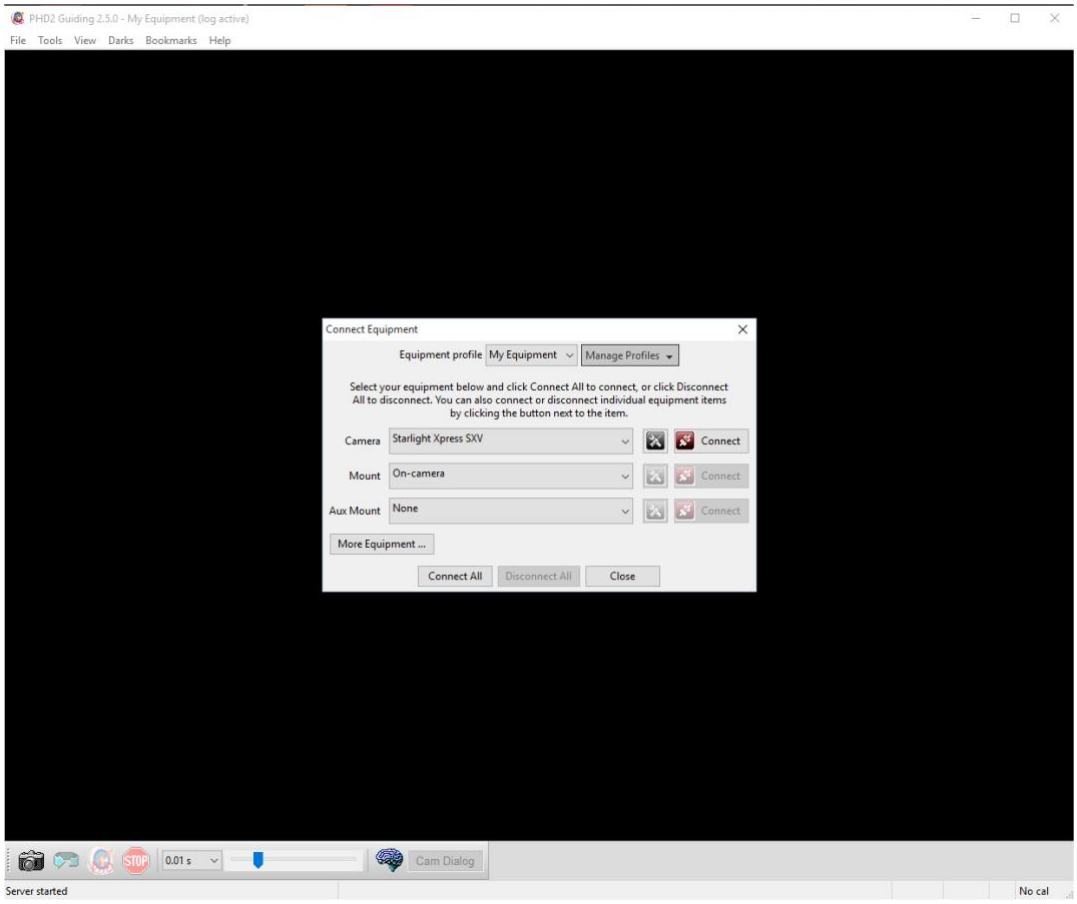


After a brief delay, the Guiding Info window will open, as above, and you will see the guide star, along with error values and a reticule showing the guide star location with respect to the reference position. If all is well, you should see the guide star location being forced towards the centre position with each successive guide image. However, it is quite likely that it will be pushed away from the correct position, due to an error in the guiding default settings. If this is the case, note the direction of travel, and then reverse the appropriate direction setting in the guiding defaults menu. For example, if the star moves away to the left or right, try reversing the 'Swap e/w direction' setting. If guiding works, but is sluggish, try reducing the 'Rate' setting in the guider settings, or increase it if the guiding oscillates from one side of the guide star to the other.

Guiding with 'PHD2'

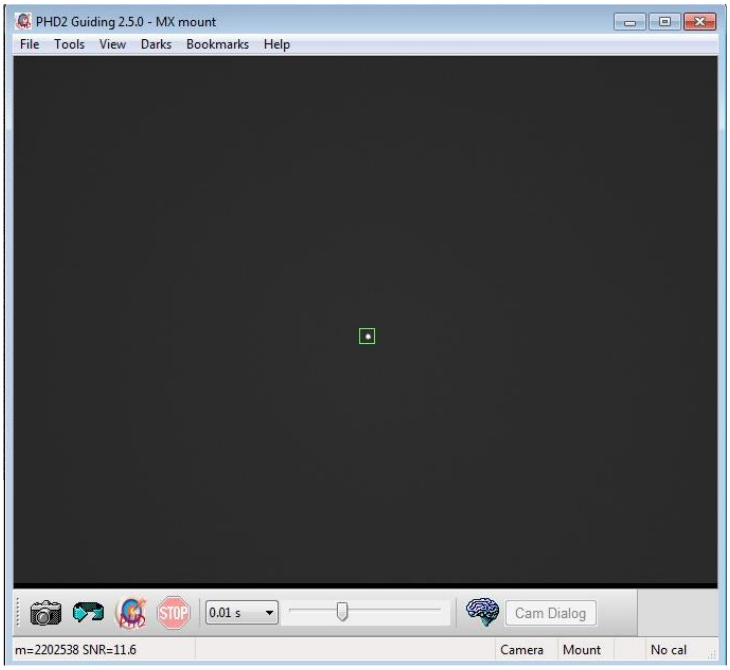
A very simple-to-use guiding program is Stark Labs 'PHD2' (http://openphdguiding.org/). I recommend this as a good and simple way to guide with the Lodestar PRO and I use it myself on most occasions.

To guide with PHD2, first press the 'camera' icon and select the 'Starlight SXV' option for the camera. If you have more than one SX camera connected, then choose 'Lodestar' or 'Lodestar X2' from the list.

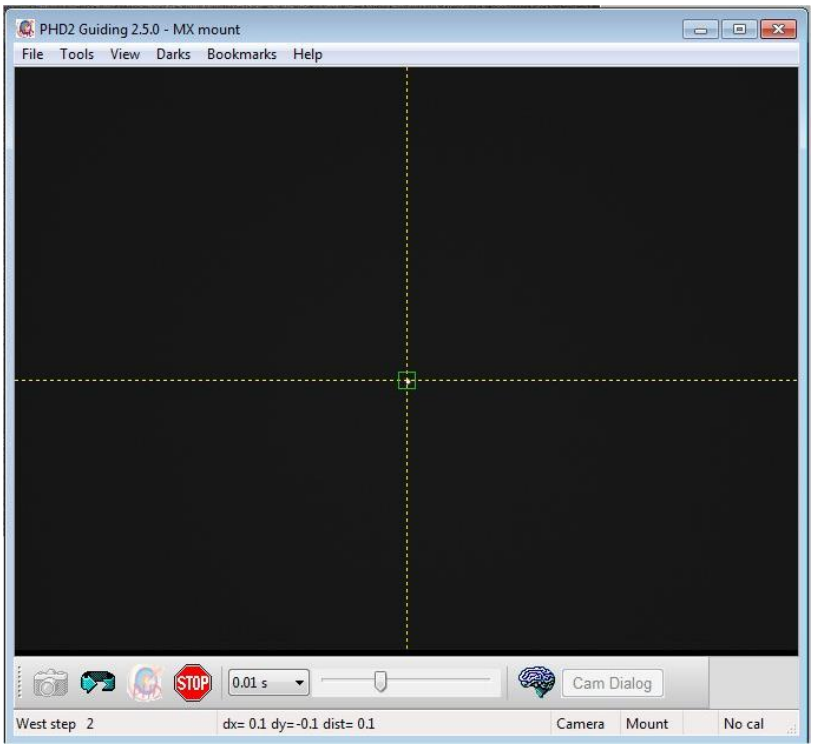


Next, press the ‘Mount’ button and select ‘On camera’ (this uses the RJ12 cable to feed corrections to the mount). You can also set these as the default by using the ‘Manage Profiles’ selection at the top of the box. Close the settings window when finished.

Now press the ‘Loop’ icon and you should see a continuously updating star field. Focus and select the best exposure time, then press ‘Stop’.



Click the mouse on a suitable guide star in your last image and then select the ‘Target’ icon. PHD2 will set up a cursor and box on the guide star and proceed to ‘calibrate’ the mount. After about 1 minute of calibration, it will start to guide on the star.



Lodestar PRO maintenance:

The Lodestar PRO head is designed for a long and reliable lifespan and needs very little maintenance to keep it in good working order. The only common issue is with dust particles which collect on the CCD window and can shade areas of the image field. These are best removed with a quick blast of compressed air from a ‘Dust off’ aerosol, or similar air blower. More permanent marks may be removed with a drop of alcohol on a ‘microfibre’ lens cloth.

Dear User,

Thank you for purchasing a Starlight Xpress product. We are confident that you will gain a great deal of satisfaction from this equipment, but please read carefully the instruction manual, supplied with your product, to ensure that you achieve the best performance that it is capable of providing.

As with most sophisticated equipment a certain amount of routine maintenance is necessary to keep the equipment operating at its optimum performance. The maintenance has been kept to a minimum, and is fully described in the manual.

Starlight Xpress Ltd. warrants all Starlight Xpress products to be free from defects in workmanship and materials, under normal operating use and conditions, for a period of two (2) years following the original invoice date. This limited warranty does not cover failures due to abuse, accidental damage, or when repairs have been made or attempted by anyone other than Starlight Xpress. A defective product meeting the warranty conditions set forth herein will be replaced or repaired at no charge.

Replacement or Repair
If a product arrived with the user and is immediately faulty, Starlight Xpress, if contacted within 30 days of purchase, and with evidence proving a defective product, will offer a free replacement, subject to the verification of the defect or malfunction. The customer shall return the complete product package, including all parts, accessories, and manuals, etc. for a replacement.

Exclusions:

1. The equipment shall only be used for normal purposes described in the standard operating instructions, and within the relevant safety standards of the country where the equipment is used.
2. External mechanical force (i.e. dropped, scratched sensor window, damaged metalwork, a broken or damaged USB port, power supply connector etc.)
3. Water or moisture inside the product due to improper storage or use.
4. The guarantee shall not apply to the equipment damaged by flood, fire, earthquake, lighting strike etc. (Force majeure)
5. Disassembling, repairing, or refurbishment made or attempted by anyone other than Starlight Xpress without prior authorisation.
6. This guarantee shall not apply to components that have a naturally limited life.
7. Starlight Xpress' decision in all matters is final, and any faulty component which has been replaced will become the property of Starlight Xpress Ltd.

This Limited Warranty is NOT transferable and applies ONLY to direct customers who purchase product from Starlight Xpress or/and its authorized dealers.

Please don't forget to register your SX Product at https://www.sxccd.com/support/warranty-policy-and-registration/ to initiate your warranty

For further info. or advice, please contact us:
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