

## **Telescope Startup & Calibration Guide (Lights, Camera, Action!)**

The following is a detailed step-by-step guide for getting the telescope and camera up and running from a cold start. At first glance this looks like a ton of information and will be somewhat confusing the first time you go through the process. However after a couple of startups it will become much easier and quicker to do. This guide assumes you've completed the CCD Imaging Lab, worked with CCDSOFT 5 and have at least perused the manual for TheSky 6.

### **POWERING UP:**

At the base of the telescope pier there is a small door in the floor, marked out in yellow tape. This gives you access to the power switches for the observatory and telescope, Turn on the following:

Telescope Switch ON, this will power up the telescope controller and camera. You should hear the filter wheel clicking.

Red Lights (with dimmer) ON

There is also access to the white light switch here (labeled lights) and each of the 4 red lamps has an ON/OFF Switch.

### **LINKING UP:**

Open both CCDSOFT 5 and TheSky 6 from shortcuts on the desktop.

### **Connecting the Imaging CCD and Filter Wheel**

You'll want to start cooling the main imaging camera first as it will take 20 – 30 minutes for the temperature to stabilize. You should be familiar with the CCDSOFT interface from the CCD Imaging Lab but to review:

Open the *Camera Control* window from the *Camera/Setup* menu item. Make sure that the radio button next to the *Settings* buttons is set to *Imager*.

The Camera and Filter Wheel fields should already be set to *Apogee Alta Driver 1.0.0.3* and *Apogee Filter Wheel* respectively.

The *Filter Wheel* must be found and set manually each time you connect. To do this click on the *Settings* button to the right of the *Filter Wheel* field, click *More* then *Find* and then *Search* in subsequent popup windows. A list should show *the Apogee Camera and Filter Wheel*. Select the filter wheel and click *OK* until you're back to the Camera Control Window. Don't bother checking the Remember these settings box.

Click *Connect*.

Once connected, click *Temperature* then the *ON* radio button. Set the temperature to around 30 C *below ambient* and click *OK*.

Your imaging CCD is now connected and cooling.

### Connecting the Autoguider Camera

From the *Camera Control Window* click the *Autoguider* radio button. The Camera field should be set to *Starlight Xpress SXV Series*. Yes it's actually called the Starlight Express, google it.

Click *Connect*.

Your Autoguider Camera is now connected.

### Connecting the Computer to the Telescope Controller

In *TheSky*, open the *Telescope Menu* Item then *Link/Establish*. This should take a few seconds and a small window will pop up. This is the telescope driver. Other than turning tracking on/off you won't be using this window so minimize it.

You can now use the *Hand Pad* to move the telescope in one of three speeds. In order of descending speed these are: *Slew*, *Pan or Guide*. Pressing the *SPD* button on the *Hand Pad* will change these speeds. When you change the speed the computer will tell you which speed you're using with a slightly unsettling audio cue...

## CALIBRATING THE TELESCOPE

The telescope is now connected to *TheSky* but doesn't yet know where it is pointing. Do the following:

Use the *Hand Pad* to center a bright star in the *Telrad or Finder Scope*. Good stars for this are Arcturus or Spica. Both are very bright and easy to find in the southern sky as well as in *TheSky*.

In *TheSky*, click on the star you've chosen to calibrate on. A popup information window will list information about the star (name, magnitude, coordinates, etc.)

Using *CCDSOFT*, take an image on the *Imaging CCD with the H-a filter*. A one or two second exposure should do the trick, producing a relatively small, circular image.

Using the *Hand Pad on the Pan speed*, center the star in the *Imaging Camera* field by moving the scope, taking an image and adjusting accordingly. Do this until the star is centered.

Once you're satisfied with your positioning go back to *TheSky* and click the *Telescope tab* on the popup information window, then click the *Sync* button.

Another window will open. Either click *Offset Init* or wait a few seconds and it will initialize automatically, giving an audio confirmation. Click *OK* to close the window.

The telescope is now calibrated and *Synced with TheSky*. A crosshair and various viewfinders should be centered on your calibration star. The crosshair shows where the telescope is pointing. The circles and boxes are field of view indicators. The large circle is your Finder Scope, the larger box is your Imager and the small offset box is your autoguider. You may have to zoom in quite a bit to see the boxes. The images you take should roughly match what you see in these boxes, mirror flipped and reversed.

Once you have Synced the telescope DO NOT TOUCH THE TELESCOPE OR MOVE IT BY HAND as this will change your calibration and you'll have to repeat it.

You now have a point and slew interface via *TheSky*.

## MOVING THE TELESCOPE VIA TheSky

You can move the telescope directly using the *hand pad*, the telescopes position in *TheSky* will update as you move.

To find an object to slew to in *TheSky* you can either click on it directly or click the *binoculars icon* on the toolbar then find your object in the menu and click *Find*.

Click the *slew icon* on the bottom right of the information popup window (the *little green telescope*). The telescope will now slew to the object you've selected and give an audio alert when the slew is complete.

Take an image with your *imaging CCD* to check that you've indeed found your object.

## CALIBRATING THE AUTOGUIDER

In *TheSky*, use the autoguider viewfinder to locate a guide star that is bright enough (up to 12th magnitude works for a 10 sec exposure, 3 sec for 9<sup>th</sup> magnitude) and place it in the autoguider field of view indicator.

In *CCDSof* under the *Take Image tab*, make sure that the *Reduction method* for autoguider images is set to the *Bias, Flat, Dark* option.

Using images from the autoguider, use the hand pad to center your calibration star in the autoguider image field.

Select the *Autoguide Tab and click Calibrate*. This is an automated calibration and requires no input from you. The telescope will now take an autoguider image, moving the telescope in various directions. You should see your star moving in left/right and up/down directions in subsequent images.

It may take a few attempts to get a successful calibration. If there's a problem the "too little movement in X direction. Increase calibration time" error will pop up if something goes wrong. If you're properly connected to the telescope this won't be the case and it's usually hot pixels, too many stars, too dim a star causing the issue.

Once the calibration is successful the autoguider is ready to be used.

## IMAGING

Imaging with the main CCD is the same as in the CCD Imaging Lab. Set your *exposure time, type and autosave* options. Make sure the *Reduction menu is set to None*.

Check that the camera temperature is stabilized then begin looking for a suitable guide star and object position combination. Once you find a satisfactory setup, save an autoguider image and object image for quicker setup and acquisition in later observing sessions.

Under the *Autoguide tab*, take an image click on a star to select it and click *Autoguide*. A small window will come up showing the autoguider image after each correction. Let it run through a few iterations (10 iterations or so) to make sure the guide star doesn't drift.

Keep the autoguider running during the duration of your observing, even when not imaging otherwise you're images will be misaligned.