

Preparation of the computer and telescope

1. Set up the telescope as you normally would. This includes the battery and power wiring as well as the hand controller. Do not use an extension cable on the hand controller for this setup. The hand controller will normally live on its mounting bracket on the telescope arm. You can turn the telescope on at this point but don't start the alignment yet.
2. Turn on the computer. You should complete all of the normal connections to the camera after the computer has booted but do not start SharpCap just yet.
3. Connect the white RS232 adapter cable. The end that looks like a phone or network plus (it's an RJ9 connector) will plug into the bottom end of the hand controller. The other end is a DB9 connector. On most systems, you will need to thread this cable through the bottom of the bracket and then plug it in. When done, you can put the controller on the bracket. If you don't thread it through, you won't be able to properly seat the controller in the bracket.
4. Connect the RS232 to USB adapter cable. First connect the DB9 connector ends, then connect the USB end into the computer. Note that the camera goes into a USB port on the left side of the laptop and the RS232 to USB adapter will plug into the right side. You are now ready to start the software running on the computer.

Initializing ASCOM and SharpCap


Do not start this procedure until the telescope, computer, and camera have been powered on with all wiring connections.

- a. Open ASCOM Device Hub (find this on the desktop or accessible via the Start Menu under "ASCOM Platform") and check that next to the "Connect Telescope" button it reads "ASCOM.Celestron.Telescope", then click "Connect Telescope" (be sure that the Telescope State reads "Connected"). If this is successful, you will see information that looks like it is reading the telescope coordinates. If you see this and there are no error windows, you can skip ahead to **b.**
 - i. If prompted with the Telescope Connection Error "The port COM_ does not exist", first check that the USB cord connecting the hand controller to the laptop is plugged all the way into the laptop and is also plugged all the way into the hand controller. You should hear a jingle from the laptop when the USB cord is plugged in.

- ii. Once you are certain that the USB cord is properly plugged in, go to Tools in the ASCOM Device Hub, then select Setup. This will open the Device Hub Application and Driver Setup.
 - iii. Select the Choose button under Telescope Device. This will open the ASCOM Telescope Chooser. Verify that “Celestron Telescope” is selected in the drop-down window, then select Properties. This will open the Celestron Setup.
 - iv. The COM port in use should be indicated in the drop-down window to the right of “COM Port”. If the drop-down window is blank then the USB cord is not properly plugged in. When properly plugged in the drop-down window will read “COM_”, where “_” is the number of the COM port in use.
 - v. Select “OK” in Celestron Setup. Select “OK” in ASCOM Telescope Chooser. Select “OK” in Device Hub Application and Driver Setup. Select “Connect Telescope” in the ASCOM Device Hub. The COM port in use should be recognized now and able to connect the telescope. When properly connected, you see telescope positional information displayed.
- b.** Start SharpCap, the default profile “OCC” is loaded at the start. Here are the details of what is in the OCC profile in case you want to check that it is correct.
- i. Capture Format and Area
 - 1. MONO16
 - 2. 1920x1200
 - 3. 1x1
 - 4. FITS files
 - ii. Camera controls
 - 1. Exposure 500 ms
 - 2. Gain 300
 - 3. Frame Rate Limit: Maximum
 - 4. Amp noise Reduction: Auto (will show On)
 - 5. Offset: 100
 - 6. USB traffic: 40
 - 7. Enable Live Broadcast: Off
 - 8. Force Still Mode: Off
 - iii. GPS Controls
 - 1. GPS: On
 - 2. GPS calibration LED: Off
 - 3. Calibration Start/End set automatically, don't change.
 - iv. Image Controls (never, ever modify these)
 - 1. Gamma: 1.0
 - 2. Brightness: 0.0
 - 3. Contrast: 0.0
 - 4. Timestamp Frames: Off
 - v. Thermal Controls
 - 1. Cooler Power: Auto

- 2. Target Temperature: 0
 - 3. Temperature is not editable with these settings
 - vi. Preprocessing
 - 1. Subtract Dark: None
 - 2. Apply Flat: None
 - 3. Banding suppression: 0
 - 4. Banding threshold not editable with these settings
 - vii. Display Histogram Stretch: not saved with profile
- c. The exposure time is set to 500 ms in the OCC profile. This value should be changed manually as needed on a campaign to campaign basis but you should not save this change to the profile. To change the Exposure, manually type in the desired value then hit the “Enter” key. Do NOT use the slider to change the value as it is prone to resulting in unnecessary precision to the header, e.g. 0.100000000998405 instead of 0.1.
- d. The lightning bolt symbol next to the Histogram Stretch adjusts the contrast on the screen for better visibility. You will need to manually click the lightning bolt to activate this.
- e. Expand the “Scope Controls” tab on the right-hand side (may need to scroll down to find it) and make sure that the box next to “Connect” is checked (this is remembered from the last use of SharpCap).
 - i. The four directional arrows on the SharpCap UI move the telescope.
 - ii. The spiral in the upper left corner of the arrows is the “Spiral Search” which will automatically move the telescope in a square spiral around the starting point. This is helpful for quickly searching for any object that might be just out of the field of view.
 - iii. “Park” will park or un-park the mount (we don’t use this).
 - iv. “Stop” stops any motion.
 - v. “Rate” gives a range of slew speed from 1x sidereal rate to 3 degrees per second.
 - vi. “Tracking” will turn the tracking on or off and also allows the rate of tracking to be selected, ranging from sidereal, to lunar, to solar. We don’t normally use this.
 - vii. “Setup” will open a window in the ASCOM Device Hub for choosing which telescope to connect to (but this should be unnecessary since the telescope should’ve already been chosen before starting SharpCap).
 - viii. Finally, the button to the bottom left of the arrows is “Plate Solve and Sync”.
 - 1. Clicking this button will begin a plate solution. On the new RECON computers this takes about 10-20 seconds.
 - 2. The position of the current image will be determined using All Sky Plate Solver (this may take several minutes) and compared to the position that the telescope thinks it’s pointed. The offset between these two positions

is calculated and sent to the telescope, which will then slew to the target field. SharpCap will open a temporary status notice at the top of the screen to indicate how far the telescope position was offset; **record this value on your log sheet.**

- a. If successful, a green bar at the top of the screen will appear for about 30 seconds, stating that the Plate Solve was successful, telling you your offset from the actual field, then automatically slewing to the correct field.
 - b. If unsuccessful, a red bar at the top of the screen will be presented, stating that the Plate Solve failed. The Plate Solve and Sync can fail if the field the telescope is looking at has too many or too few stars or if the focus is really bad. Usually the problem is caused by having too few stars (not sure what the lower limit is, 10 or more stars seems to be ok). Usually, you can easily get more stars by increasing the exposure time.
3. An offset of something like 0.1 degrees (or less) seems to be typical.
 4. If you see an offset of several degrees you should be very suspicious of the telescope alignment or perhaps the plate solution. It might work, so don't panic and give it a try.
- f. Adjust settings for telescope and finderscope alignment:
- i. Overlay reticle via the icon on the upper right if desired:

 - ii. Make sure display zoom is on "Auto" to show full frame.
- g. Clicking "Start Capture" will bring up a small window where you can dictate the length of the capture by number of frames or by time. Only one can be selected at a time. Be careful when entering in the value you want for capture length, as hitting the "Enter" key will begin the capture.

Additional ASCOM notes:

- Once alignment is complete, ASCOM can be used to directly slew to the target star. From the ASCOM Device Hub, click on the "Direct Slew" tab. Enter the star's "of date" (same as you normally would use on the hand controller) coordinates from the Observing Guide (decimal hours for RA and decimal degrees for Declination), then press "Slew to Target".
- If the field is not recognizable, select the "Plate Solve and Sync" button in SharpCap as described above.
- **Important:** the normal sequence of operations for using "plate solve and sync" is to enter coordinates, slew, plate solve and sync, followed by the automatic slew to the field. In between the slew and the plate solve operation, you must not manually move the telescope. This will cause the offset to be incorrect by the amount of your manual motions. It is quite normal after

the slew to move around to find the field, hoping that you are close. That's ok to do but if you do, you will need to re-do the initial slew to the coordinates before doing the plate solve and sync command.