Appendix 2: Disassembling and Assembling the Telescopes and the Celestron Equatorial Mounts

Disassembling (classroom)

1. **The mount must be locked with the telescope situated horizontally.** Note the telescope's position with respect to the index markers located on the two axes of the mount because the telescope has to be repositioned in the same direction when reassembled.
2. **Two Persons: Remove telescope from equatorial head** by loosening the two rail clamping screws of the mount. Note the rail position markers to make reassembling and balancing the telescope easier. One person loosens the screws, while the other individual holds the scope and removes it from the rail.
3. **Detach the counterweight:** Remove the counterweight screw and stow it into the **small plastic box**. Remove the counterweight from the shaft and put it (them) into the **large plastic box** or transport the counterweights separately.
4. **Remove the equatorial head from the tripod:** Loosen the screw beneath the equatorial head until it drops and clangs; then loosen the two azimuth screws near the counterweight shaft. The equatorial head is now disconnected and can be removed from the tripod by lifting it straight up.
5. **Rotate the eyepiece holder on the tripod, and fold the tripod legs inward** for easier transportation to the Sky Deck.

6. **Transport disassembled equipment to Sky Deck:** Large Plastic Box (contains the small plastic box, blanket, Power Tank, and eyepiece case), equatorial head, tripod, and telescope are now ready to be moved to the Sky Deck.
7. **Use the elevator** to transport the heavier equipment.

Assembly of Telescope (Sky Deck)

1. **TWO PERSONS can return to the classroom to bring the telescope upstairs** if there are not enough people to transport the telescope to the Sky Deck in one trip.
2. **Ask Mr. Becker for the duplicate set of keys.** Last person out locks the classroom door.
   ----
3. **Orient the Tripod Legs** to a north-facing direction by using the sets of three painted circles marked on the Sky Deck roof. The back leg is numbered and faces south. The azimuth adjustment post faces north. Compasses will not work on the Sky Deck because of the magnetic fields created by the operating motors which are found in the room below.
4. **Vibration suppression pads:** Place one pad underneath each tripod leg. The pads can be found in the small plastic box.
5. **Swivel the eyepiece holder** on the tripod so that it connects with the legs of the mount before the equatorial head is reattached to the mount.
6. **Level the Tripod:** Place the bubble level which can be found in the small plastic box into the hole on the top of the mount and adjust the tripod legs until the bubble in the level is centered.

7. **Remove the level and attach the equatorial head** to the tripod. The screw that attaches the head to the tripod should not be super tight. Make sure that the screw below the eyepiece holder (lower screw) is firmly tightened.
8. **Attach the counterweight** onto the declination shaft to the correct position indicated by the tape and secure the locking screw for safety.
9. **Attach the power cable found in the small plastic box to the telescope and Power Tank.** Turn the Power Tank to the "On" position. A red LED will show that a good connection has been made. **Don't turn on the telescope.**
10. **Attach the hand controller to the mount in the "HC" slot.** The hand controller will be found in the small plastic box. Use the Velcro on the hand controller to attach it to the Velcro on one of the tripod legs.
11. **Make sure the rail is in a horizontal position:**
12. **Place the telescope into the rail** at the location of the rail positioning marker(s) of the mount and lock to secure.
13. **Point the telescope north.** Note that the index markers must align. If they do not, and the telescope is pointed south, it must be derailed and turned around.
14. **Point the telescope horizontally again.**
15. **Attach the power cable found in the small plastic box to the telescope and Power Tank.** Turn the Power Tank to the "On" position. A red LED will show that a good connection has been made. **Don't turn on the telescope.**
16. **Attach the hand controller to the mount in the "HC" slot.** The hand controller will be found in the small plastic box. Use the Velcro on the hand controller to attach it to the Velcro on one of the tripod legs.

Balancing the Telescope

1. **Unlock the declination clamp and move the telescope back and forth.** If the telescope feels unbalanced (pulls in one direction), reposition the telescope horizontally. Loosen the two rail clamps and move the telescope along the rail **(two-person procedure)** in the opposite direction of the unbalance. Retighten the rail clamping screw each time the balance is tested until a good balance is achieved.
2. **Unlock the right ascension (polar axis) clamp and rotate the polar axis**. If the telescope feels unbalanced, clamp the axis and move the counterweight in the opposite direction of the imbalance until the correct balance is achieved.

Aligning the Telescope to Polaris (North Star)

1. **Remove all caps** from the finder scope and the telescope and place these in the small plastic box. Turn on the reticle illuminators if conditions are dark enough.
2. **Index markers synced:** Move each axis so that the index markers on both axes are pointing towards each other. The telescope should now be "looking" north.
3. **If it is dark enough, locate Polaris in the sky** to see if the telescope is essentially pointing in the direction of that star.
4. **Locate Polaris in the smaller finder scope.** If Polaris is not in the finder, use the ultra-widefield box finder with the bullseye. Move the telescope in azimuth by working the two horizonal azimuth screws found near the (declination) shaft supporting the counterweight. Adjust these knobs back and forth until Polaris is located and best centered on the bullseye and then in the finder scope. One person should be doing the looking, while another individual

makes the adjustments. A third individual could be looking into the main telescope's eyepiece. The fourth individual should be reading the directions.

5. **Loosen the altitude screws** (front and back of mount) and work both together to raise or lower the mount to center Polaris. A readjustment of the azimuth may also be necessary.
6. **Center Polaris in the telescope eyepiece:** Look through the main telescope and use the same procedures to adjust Polaris, so that it is located in the center of the eyepiece's field of view in the main telescope. The last three procedures could be accomplished simultaneously. See below.
7. **Aligning as a team:** One person looks through the finder scope; one person looks through the main telescope; one person controls the azimuth screws, and one person controls the altitude screws… **Do not perform altitude and azimuth adjustments simultaneously.**
8. **Tighten all screws uniformly** once Polaris is centered in the main telescope. This includes the screw that attaches the equatorial head to the tripod. Keep watching Polaris in the main telescope to make sure that all screws are tightened to similar tensions and that Polaris remains in the center of the field of view in the main telescope.
9. **Check the finder scope** to make sure that Polaris is also located in the center of its field of view. If Polaris is not centered, adjust the finder scope's alignment screws so that Polar is centered.

Syncing the Mount and Telescope to the Sky

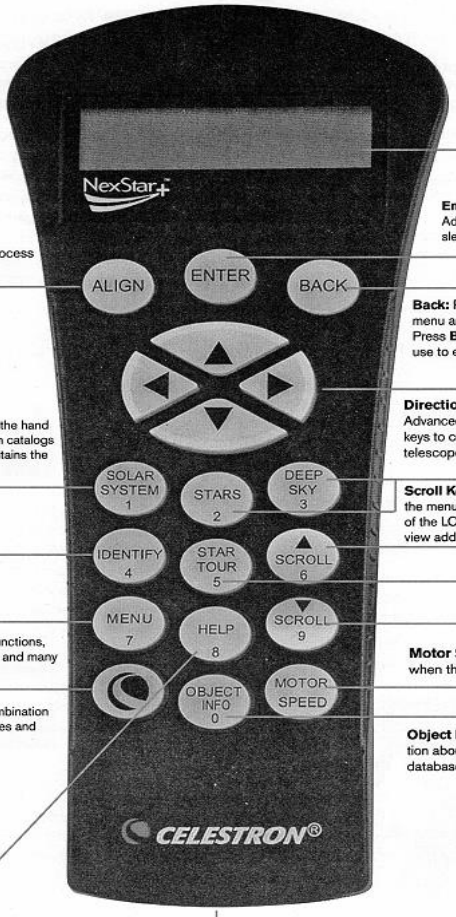
1. **Turn on the power switch of the telescope.** The Power Tank should have been turned on previously.
2. **Set the time and date:** Follow the instructions displayed on the hand controller to set the time and date. Your latitude and longitude are already inputted into the system. **Use atomic time for best precision.**
3. **The hand controller will display "2-star alignment."** Press ENTER, and it will pick a star. Press ENTER again, and the telescope will begin slewing to that object.
4. **Center the star in the finder scope:** When the scope stops and the propeller on the right side of the hand controller stops twirling, look through the finder. Move the telescope using the Up-Down-Right-Left arrow keys on the hand controller, so that the bright alignment star is centered on the crosshairs of the finder telescope. Press ENTER.
5. **Center the star in the main telescope:** Perform the same procedure with the hand controller; but this time, look through the main telescope. The telescope will move more slowly. Position the star in the center of the eyepiece. **Press ALIGN.**
6. **The controller will suggest a second alignment star.** Press ENTER. The telescope will slew to that star. The procedure for the first star alignment using the finder scope first will be repeated. When centered in the finder, press ENTER. Center the star in the eyepiece of the main telescope and then press ALIGN.
7. **Calibration stars:** The hand controller will then ask if you would like to repeat the procedure for several calibration stars. Press ENTER, and the hand controller will select the

stars for you. Follow the same procedure. Press ENTER for the finder scope alignment. Press ALIGN when the star is centered in the main telescope. This will be repeated for three or four stars.

8. **<u>Telescope ready</u>:** When the internal computer believes the telescope to be properly aligned, the hand controller will display **"Advanced VX" or "CGEM ready."** You are now set to take control of the universe.

Computerized Hand Control

The Advanced VX uses the NexStar+ hand control that is designed to give you instant access to all the functions your mount has to offer. With automatic slewing to over 40,000 objects and common sense menu descriptions, even a beginner can master its variety of features in just a few observing sessions. Below is a brief description of the individual components of The NexStar+ hand controller:



Liquid Crystal Display (LCD) Window — 1

Enter: Pressing **ENTER** allows you to select any of the Advanced VX functions, accept entered parameters and slew the telescope to displayed objects. — 8

Align: Instructs the hand control to begin the process of aligning your telescope. — 2

Back: Pressing **BACK** will take you out of the current menu and display the previous level of the menu path. Press **BACK** repeatedly to get back to a main menu or use to erase data entered by mistake. — 9

3 — **Direction Keys:** Allows complete control of the Advanced VX mount in any direction. Use the direction keys to center objects in the eyepiece or manually slew telescope.

Catalog Keys: The Advanced VX has a key on the hand control to allow direct access to each of the main catalogs in its 40,000+ object database. Your mount contains the following catalogs in its database: — 4 **Catalog Keys**

Scroll Keys: Used to scroll up and down within any of the menu lists. A double arrow symbol on the right side of the LCD indicates that the scroll keys can be used to view additional information.

5 — 11 **Scroll Keys**

10 **Sky Tour**

6 — 11 **Scroll Keys**

Menu: Displays the many setup and utilities functions, such as tracking rate and user defined objects and many others.

Motor Speed: Slews the telescope faster or slower when the direction buttons are pressed. — 12

7 — **Option (Celestron Logo):** Can be used in combination with other keys to access more advanced features and functions.

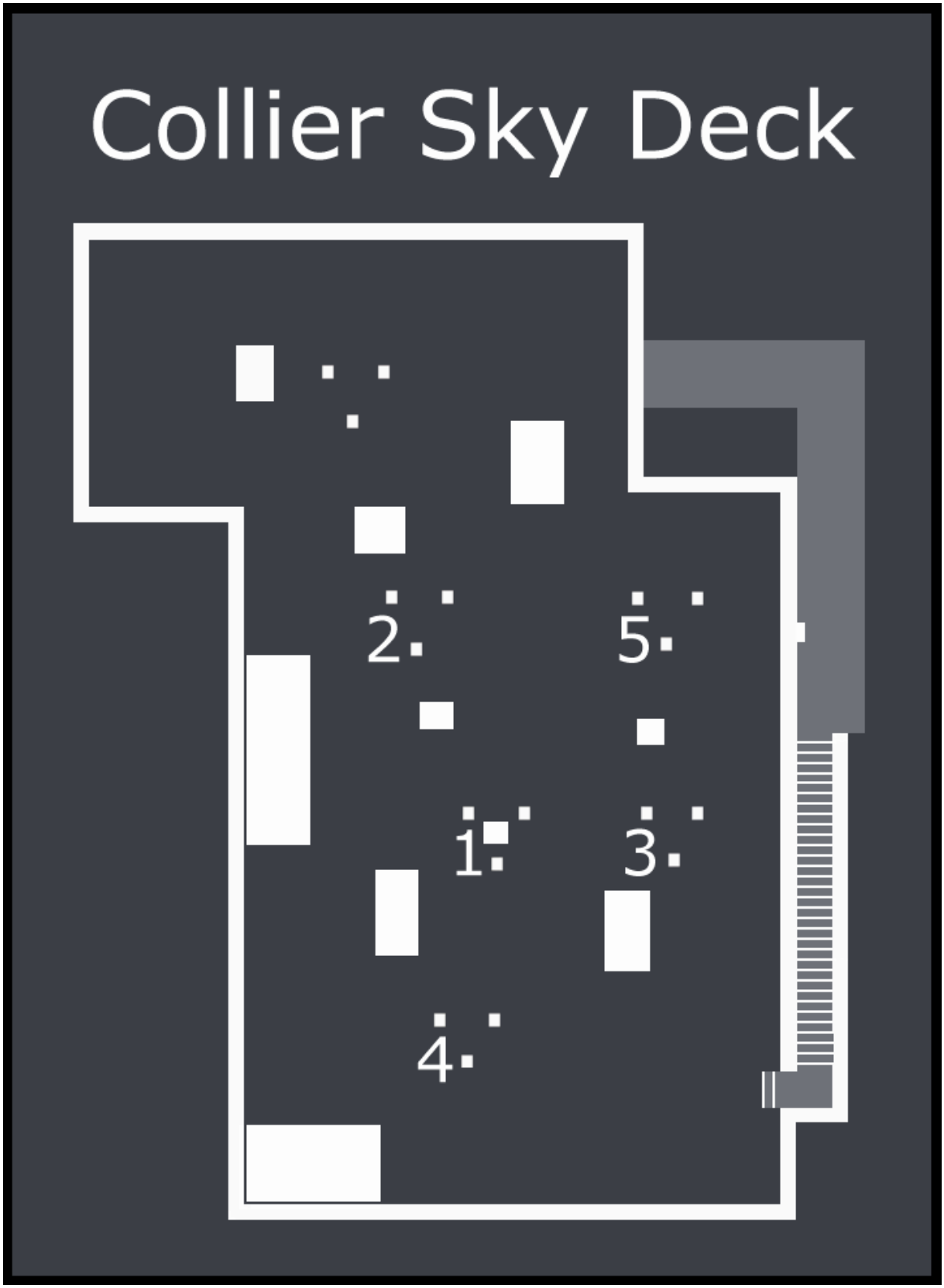
13 — **Object Info:** Displays coordinates and useful information about objects selected from the Advanced VX database.

15

14 **RS-232 Jack**

Telescope Observations in a Nutshell

1. The post on your tripod must point north.
2. Vibration suppression pads must be in alignment with the white circles on the Sky Deck.
3. Level your tripod.
4. Check to make sure that your telescope is balanced.
5. Don't turn the telescope on until you find Polaris (North Star).
6. Set the alignment markers. Use the azimuth knobs (right-left) and altitude knobs (up-down) on your telescope to center Polaris in your finder and main scope.
7. Turn on the telescope.
8. Input atomic time into the hand control when asked.
9. Find and center two alignment then find and align four calibration stars using the **"enter"** button for the finder alignments and the **"align"** button when object is centered in your main scope.
10. When hand control says Advance VX or CGEM ready, you are set to discover the universe.
11. If the moon is bright, concentrate on finding double stars.



February 25, 2018

NOTES