SmartEQ™ and SmartEQ™ Pro
Portable German Equatorial GOTO Mount

Instruction Manual

Product #3100 & 3200

Table of Content

WARNING!

NEVER USE A TELESCOPE TO LOOK AT THE SUN WITHOUT A PROPER FILTER!
Looking at or near the Sun will cause instant and irreversible damage to your eye.
Children should always have adult supervision while observing.

1. SmartEQ^{TM} Mount Overview

Born out of the popular iOptron Cube^{TM} and iEQ^{TM} mounts, the SmartEQ^{TM} mount is the ultimate Grab N' Go German equatorial GOTO mount fitting into almost everyone's budget. It is ideal for visual observation and wide field astrophotography. The compact design and light weight make traveling with the mount easy.

SmartEQ^{TM} mount is a fully computerized mount with a database of 50,000 objects. It offers the next generation GOTO technology from iOptron. The Go2Nova® Hand Controller is intuitive with a large LCD screen, with which you can easily set up your telescope and select where you want to navigate.

SmartEQ^{TM} Pro mount has metal wheels (aluminum alloy) and worm shafts (brass) to enhance the mount performance. It also equipped with an ST-4 compatible guiding port for those who wants to autoguide the mount. An iOptron AccuAligning^{TM} Polar Scope is also equipped for better polar alignment (optional for SmartEQ^{TM} mount).

A newly added BrightStar Polar Alignment procedure ensure a better polar alignment for those who does not have a polar scope or can not see the pole star.

SmartEQ^{TM} mount is universally compatible with any tubes using a Vixen-style dovetail connection, making it useful for beginners as well as hobbyists with multiple tubes.

Features:
- Specialized Grab N' Go mount ideal for visual observer and wide field astro-photographer
- Portable, compact, and sturdy German equatorial mount that is easy to travel with
- Payload: 11 lbs (5 kg) (excluding counterweight)
- Mount weight: 6.2 lbs (2.8 kg)
- Dual-axis servomotor with optical encoder
- Drive motor with 9-speed setting for precise tracking
- Resolution: 0.5 arc second
- Go2Nova® 8408 controller with Advanced GOTONOVA® GoTo Technology
- Over 50,,000 celestial objects for easy surfing
- Low power consumption (8 AA batteries for 16 hours consecutive tracking)
- Retractable counterweight shaft
- Vixen-type dovetail saddle
- Standard 1.25 inch heavy-duty stainless steel tripod
- Serial port for firmware upgrade and computer controller
- Metal wheels and worm shafts (SmartEQ Pro mount only)
- ST-4 guiding port (SmartEQ Pro mount only)
- BrightStar Polar Alignment procedure
- AccuAligning^{TM} bright field polar scope (optional for SmartEQ^{TM} mount, Part# 3130, and standard for Pro mount)
- Optional 1.25A AC/DC adapter

2. SmartEQ^{TM} Mount Assembly

2.1. Parts List[1]

The SmartEQ^{TM} mount shipping box contains:

- SmartEQ^{TM} telescope mount
- Go2Nova® #8408 hand controller
- 1.25-inch stainless steel tripod with accessory tray
- One 2lbs (0.9 kg) counterweight
- One hand controller cable

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[1] US market only. Actual contents may vary.

- Installed polar scope for SmartEQ™ Pro mount.

ONLINE CONTENTS *(click under "Support" menu)* **www.iOptron.com**

- Quick Start Guide
- This manual
- Tips for set up
- Hand controller firmware upgrade (check online for latest version)
- Reviews and feedback from other customers

2.2. Introduction

You have just purchased a telescope mount that is capable of taking you to a new level of astronomy. No matter which telescope or optical tube assembly (OTA) you select to install on the mount, the overall performance will be greatly enhanced. In order for you to get the optimum performance from the mount and OTA combination, you must assemble and adjust the mount correctly. The following fundamentals of telescope mounts are included to help you understand the big picture before you get into the specific details of the SmartEQ™ mount.

Telescope mounts are either equatorial mounts or altitude-azimuth (Alt-Az) mounts. Both types of mounts rotate the OTA around two perpendicular axes to point to a desired object in the night sky. An equatorial mount has the right ascension (R.A.) axis aligned with the celestial North Pole (CNP), or celestial South Pole (CSP), to provide rotation matching the celestial sphere rotation around the Earth and the declination axis (DEC) to provide elevation relative to the celestial equator. Since all celestial objects appear to rotate around the CNP, the R.A. axis allows the OTA to rotate with the celestial sphere and provide accurate tracking for visual observations and astrophotography. R.A. is the celestial equivalent of longitude. Like longitude, R.A. measures an angle that increases toward the East as measured from a zero reference point on the celestial equator. An Alt-Az mount has a horizontal axis to provide vertical (altitude) OTA movement from the local horizon and a vertical axis to provide horizontal (azimuth) OTA movement, similar to compass headings. An Alt-Az mount can provide tracking that is good enough for visual observing and short exposure photos, but not good enough for serious astrophotography. Alt-Az mounts require star alignments for the OTA to track stars and they do not have adjustment components on the mount. Equatorial mounts require alignment of the mount components as well as star alignments for accurate OTA tracking.

In order to provide the required Polar Axis alignment, equatorial mounts use a combination of both mount types described above. The adjustable part of the mount moves in the Alt-Az mode in order to align the R.A. axis, also known as the mount's Polar Axis, with the CNP. These Polar Axis adjustments do not involve any rotations of the OTA about the R.A. or DEC axes and can be performed without the OTA installed. The first step is to make an approximate azimuth alignment of the Polar Axis by aligning the specified tripod leg or reference point toward True North using a compass for reference (you must allow for the variation between True and Magnetic North at your location). Precise horizontal alignment of the Polar Axis is accomplished with azimuth adjustments on the mount. The second step is to adjust the Polar Axis vertically (altitude) above the North horizon by setting the observer's latitude on the provided latitude scale. This procedure is based on the fundamental geometry of the Earth's coordinate system in conjunction with the concept of the celestial sphere. You can verify this by visualizing yourself at the North Pole (latitude N90°) and Polaris will be 90° from the horizon, or directly overhead. These steps will place the Polar Axis very close to the CNP. Both of the above adjustments can be enhanced by the use of an opening along the R.A. axis that allows direct viewing of the North Star and the use of a polar scope to view through this opening. If you are going to get the most out of your equatorial mount it is essential to understand the concept of the Polar Axis and how the equatorial mount helps you establish and maintain a true Polar Axis alignment. Now, you are ready to perform star alignments using the equatorial mount's electronic controller and enjoy the night sky.

The SmartEQ™ mount is a next-generation equatorial mount. The following sections of this manual provide the detailed steps required to successfully set up and operate a SmartEQ™ mount.

2.3. SmartEQ^{TM} Mount Assembly

NOTE: The SmartEQ^{TM} mount is a precision astronomical instrument. It is highly recommended that you read the entire manual and become familiar with the nomenclature and function of all components before starting the assembly.

STEP 1. Setup Tripod

Expand the tripod legs. Put the Accessory Tray onto the Tripod Support Bracket. Slightly push down Accessory Tray while turn it, until the tray is locked into the Tripod Support Bracket. **(Figure 1)**. Adjust the tripod height by unlocking and re-locking the tripod leg screws (not shown) to a desired height. Position the tripod so that the Alignment Peg faces north, if you are in Northern Hemisphere **(Figure 2)**.
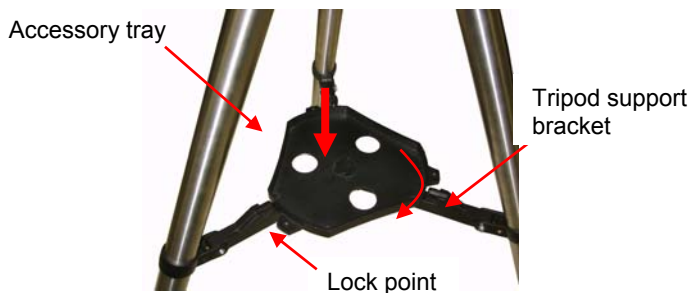
Figure 1. Install tripod support bracket

Figure 2. Alignment peg position

The Alignment Peg may be moved to the opposite position if used at latitude lower than 20º to avoid counterweights hit the tripod leg.

STEP 2. Attach the SmartEQ^{TM} Mount:

Remove the Latitude Adjustment Screw from its Storage Position by unscrewing it all the way out **(Figure 3)**. Retract the Azimuth Adjustment Knobs to allow enough clearance for the Alignment Peg seating in the house. Tighten the Azimuth Lock to secure the mount **(Figure 4)**.
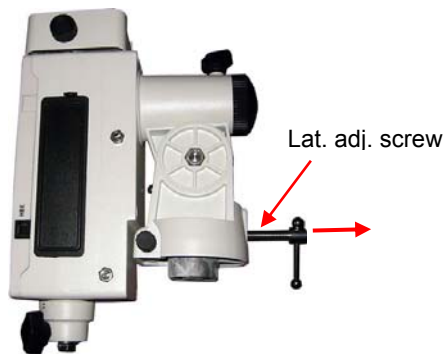
Figure 3. Remove Latitude Adjustment Screw

Figure 4. Install mount onto the tripod

Thread in the Latitude Adjustment Screw into the Adjustment Position, a threaded hole above the Storage Position **(Figure 5)**. Loosen the Latitude Clutch Screw and tune the Latitude Adjustment Screw to raise the mount altitude (latitude) to about 30 degree, as shown in **Figure 6**.
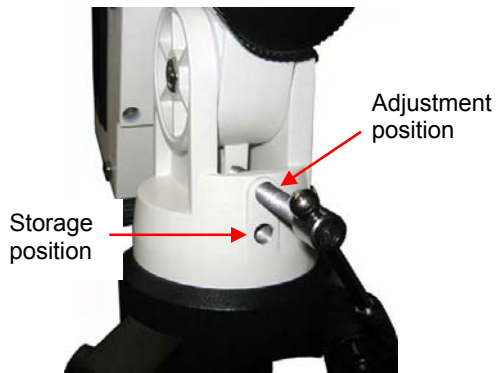
Figure 5. Move latitude adjustment screw
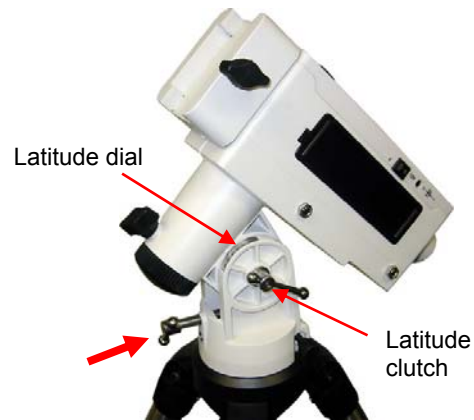
Figure 6. Adjust mount latitude

STEP 3. Install Batteries and Connect Cables:

There are two battery compartments that each can hold 4 AA batteries **(Figure 7)**. Lift the battery cover. Carefully pull out the battery holder from the compartment. Be sure not to accidentally disconnect the wires. Insert 4 AA batteries into each holder. Replace the holder back into the battery compartment and replace the lid. Plug hand controller into the HBX port on the mount **(Figure 8)**. Turn on power and use four Arrow keys (▲▼◄►) to rotate the mount Up, Down, Left, and Right. Use the NUMBER key to change the slew rate from the slowest (1 for 1X) to the fastest (9 for MAX).
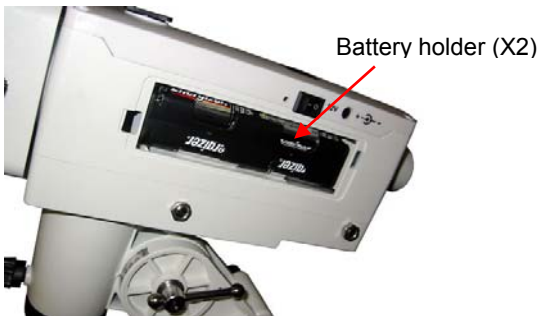
Figure 7. Battery holder

Figure 8. Connect control cable

STEP 4. Set the Location Latitude and Polar Alignment:

In order for an equatorial mount to track properly, it has to be accurately polar aligned. This is achieved by making the polar axis of the mount parallel to that of the Earth's axis of rotation.

This step requires you to know the latitude of your current location. It can be easily found on the Internet, with your GPS navigator or a GPS capable cell phone. You will have to change this latitude setting every time you significantly change your night sky viewing location. This setting directly affects the mount's tracking and GOTO accuracy.

Unlock Latitude Clutch. Turn the Latitude Adjustment Screw to set your current latitude as indicated on the Latitude Dial. This should be good enough for a casual visual observation.
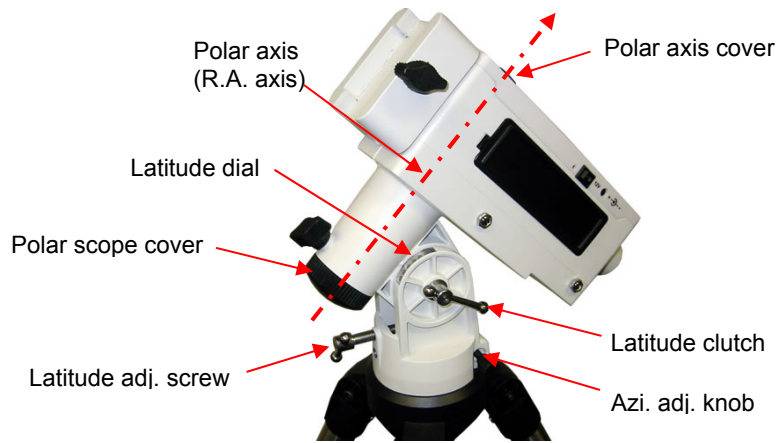
Figure 9. Align mount to the celestial pole

For a better polar alignment, one may use the polar scope opening on the R.A. axis. Take off the Polar Axis Cover and Polar Scope Cover. Release the Counterweight (CW) Shaft Locking Screw to pull the CW Shaft out of the mount. Look through polar scope opening to find the Polaris. If the opening is blocked by the DEC axis, power the mount on and use the ▲ or ▼ button on the hand controller to turn the DEC axle to unblock the view. (You may use the number button to change the slewing speed. 9 for MAX speed). Loosen the Azimuth Locking Screws and adjust the mount to center the Polaris in the azimuth direction using Azimuth Adjustment Knobs. Tighten the locking screws to secure the mount. Loosen Latitude Clutch on the side of the mount, turning the Latitude Adjustment Screw to adjust the latitude (altitude) to center the Polaris along the altitude direction. Re-tighten the locking screws.

If an AccuAligning™ polar scope is installed (standard for a SmartEQ™ Pro mount, and optional for a SmartEQ™ mount), please follow **Section 4.1.1** to perform the Quick polar Alignment.

STEP 5. Install Counterweight (CW):

The mount comes with one 2 lbs (0.9 kg) counterweight. However, because of its unique design, no CW is needed if the payload is less than 4 lbs. The mount and installed batteries will provide balancing weight needed. If a payload is greater than 8.8 lbs (4 kg), additional CW is needed. The Counterweight Shaft is stored inside the mount head. If a CW is needed, release the CW Shaft Locking Screw to pull out the shaft (**Figure 10**). Mount a CW onto the shaft and tighten the CW Locking Screw to hold the CW in place. Tighten the CW Safety Screw (**Figure 11**).
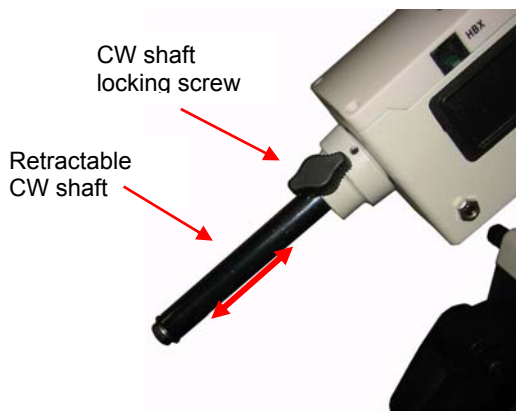
Figure 10. Release CW shaft
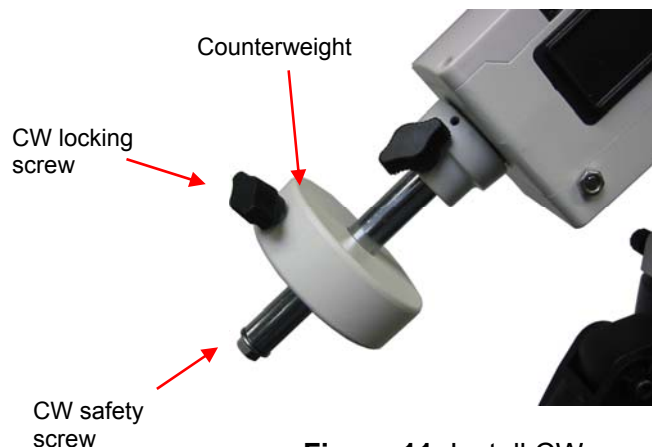
Figure 11. Install CW

STEP6. Attach and Balance an OTA on the Mount:

After attaching an OTA and accessories to the mount, balance the mount in both R.A. and DEC to ensure minimum stress on the mount.

CAUTION: The telescope may swing when the R.A. or DEC clutch is released. Always hold on to the OTA before you release the clutch to prevent it from swinging. It can cause personal injury or damage to the equipment.

Figure 12. R.A. and DEC cluthes

Balance the mount in R.A. axis

Release the R.A. Clutch and rotate the R.A. axis to place the DEC axis in the horizontal position. The OTA can be on either side. If the DEC axis stays in the horizontal position, it means the R.A. axis is balanced. Otherwise, you may adjust the length of CW shaft, or install and adjust CW position to balance the mount in R.A. axis. Remember to install the CW Safety Lock and tighten the CW Locking Screw, if a CW is installed.

Balance the mount in DEC. axis

Balance in DEC axis is not that critical since the maximum payload is only 11 lbs. Release the DEC Clutch and if the OTA does not rotate along the DEC axis, it is OK. Tighten the DEC Clutch again.

Adjust the Mount to Zero Position

The Zero Position is the position where the counterweight shaft points to ground, telescope is at the highest position with its axis parallel to the polar axis and the telescope is pointing to the Celestial Pole. Loosen the DEC and R.A. Clutches to adjust the mount to the Zero Position by align three marks located on DEC unit, R.A. unit and mount, respectively. Tighten the screws after adjustment. Make sure the hand controller is also at the zero position, which can be ensured by turn the mount power off and on again.

Figure 13. Zero Position
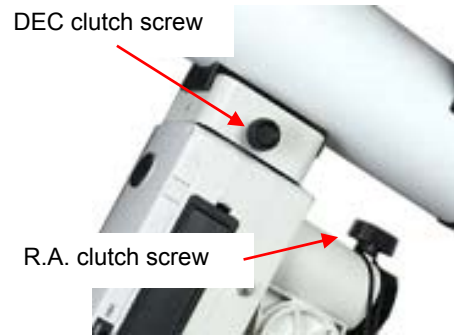
3. Go2Nova® 8408 Hand Controller

Figure 14. Go2Nova 8408 hand controller

The Go2Nova® 8408 hand controller (HC) shown in **Figure 14** is the standard controllers that used for the SmartEQ™ mount. It has a 4 line, 21 character large LCD screen, function keys, direction keys and number keys on the front; and a HBX port (6-pin) and a serial port (4-pin) at the bottom.

3.1. Key Description

- MENU Key: Press "MENU" to enter the Main Menu.
- BACK Key: Move back to the previous screen, or end/cancel current operation, such as slewing.
- ENTER Key: Confirm an input, go to the next menu, select a choice, or slew the telescope to a selected object.
- Arrow (▲▼◄►) Keys: The arrow keys are used to control the movement of DEC and R.A. axes. Press and hold ▲(DEC+),▼(DEC-) buttons to move a telescope along the DEC direction, ◄(R.A.+), ►(R.A.-) to move a telescope along the RA direction. They are also used to browse the menu or move the cursor while in the menu. **Holding an arrow key for a fast scrolling.**
- Number Keys: Input numerical values. Also used to adjust slewing speeds (1: 1X; 2: 2X; 3: 8X; 4: 16X; 5: 64X; 6: 128X; 7: 256X; 8: 512X; 9: MAX)
- ? Key: **Identify and display nearby bright stars or objects where the telescope points to.**
- 0 Key: Stop the mount during GOTO. **Also toggling between start and stop tracking.**
- HBX (Handbox) port: connect the HC to the SmartEQ mount using a 6 pin 4 wire (6P4C) RJ11 plug.
- Serial port: connect the HC to a Computer via a RS232 to 4 pin 4 wire (4P4C) RJ-9 cable (iOptron item# 8412). The pin out of the serial port is shown in **Figure 15**.
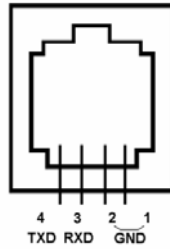
Figure 15. Serial port pin out on an 8408 hand controller

3.2. The LCD Screen

The 8408 HC has a large 4-line, 21-character per line LCD screen. The user interface is simple and easy to learn. When the mount first turned on, an initial information screen will be displayed as shown in **Figure 16**, after company logo displayed. It displays the Zero Position, current date and time.
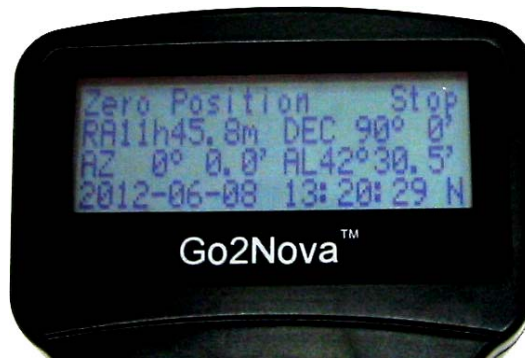
Figure 16. 8408 Initial Information Screen

The LCD screen will switch to the information screen, as indicated in **Figure 17**, with pressing any button.
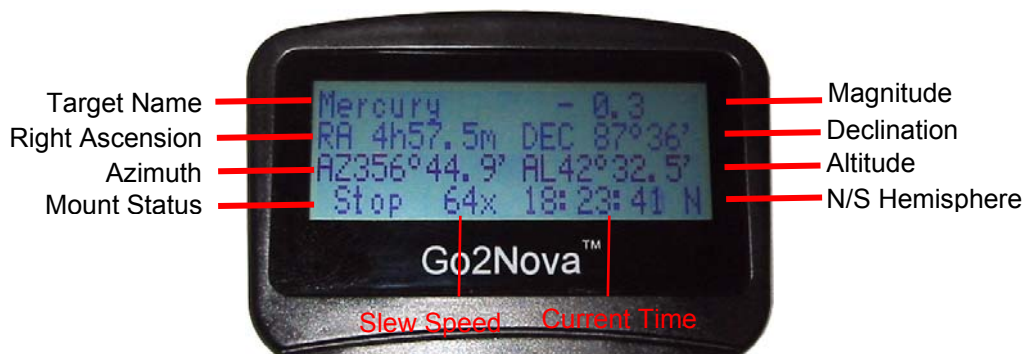
Figure 17. 8408 HC LCD Information Screen

1. Target Name/Mount Position: displays the name of the target that telescope is currently pointed to or the current mount position.
    - An object name, such as "Mercury" or "Andromeda Galaxy": Name of the Star or celestial object that the mount is currently slewing to, GOTO or tracking;
    - User Position: The mount is point to a user defined position, which could be a real sky object or just simply due to press an arrow key.
2. Magnitude: the magnitude of the current celestial object
3. Right Ascension: Right Ascension of the telescope, or R.A.

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4. Declination: Declination of the telescope, or DEC.

5. Azimuth: Azimuth of the telescope (north is 0º, east 90º, south 180º, and west 270º).

6. Altitude: Altitude of the telescope (degrees vertical from the local horizon - zenith is 90º).

7. Mount Status: Display current operation status of the mount.
    - Stop: mount is not moving;
    - Slew: mount is moving with an arrow key is pressed;
    - GoTo: mount is slewing to a celestial object using "Select and Slew";

8. Slew speed: It has 9 speeds: 1X, 2X, 8X, 16X, 64X, 128X, 256X, 512X, MAX (~4º/sec, depends on power source).

9. Current Time: display local time in a format of HH:MM:SS.

4. Getting Started

In order to experience the full GOTO capability of GOTONOVA® technology it is very important to set up the mount correctly before observation.

4.1. Setup the Mount and Polar Alignment

Assemble your SmartEQ™ mount, perform Polar Alignment and mount your telescope or camera. The default position for the mount is the Zero Position when the power is switched on, as shown in **Figure 13**: the counterweight shaft is pointing to ground, telescope is at the highest position with its axis parallel to the polar axis and the telescope is pointing to the North Celestial Pole, if you are located in northern hemisphere. Point the telescope to South Celestial Pole if you are located in southern hemisphere.

4.1.1. Quick Polar Alignment

If your SmartEQ™ mount has an optional AccuAligning™ polar scope installed, or you have an SmartEQ™ Pro mount, you may use this Quick Polar Alignment procedure to perform a precise polar alignment.
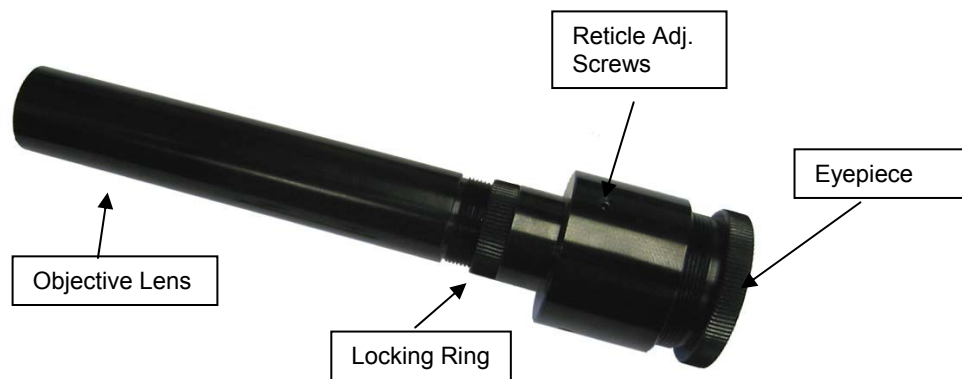
Figure 18. Polar Scope

1. Insert 8 AA batteries into the battery packs or connect the mount with an AC/DC power adapter. Plug the Go2Nova hand controller into the mount HBX port. Turn the power switch on.

2. Make sure that the DEC axle is not blocking the polar scope view by turn the DEC axle using UP or DOWN button. Press the Number key to change the speed.

3. Use hand controller **Set Polar Light** command under **Set Up Controller** menu to adjust the LED brightness to a comfort level.

4. Adjust polar scope eyepiece shown in **Figure 18** to bring the Polar Scope Dial in focus.
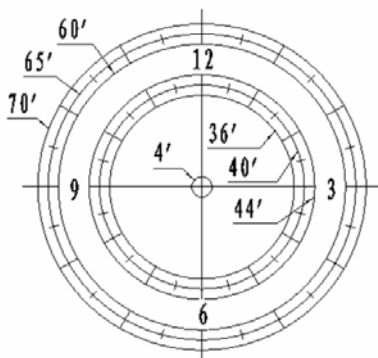
Figure 19. Polar Scope Dial

Figure 20. Zero position mark

As indicated in **Figure 19**, the Polar Scope Dial has been divided into 12 hours along the angular direction with half-hour tics. There are 2 groups, 6 concentric circles marked from 36' to 44' and 60' to 70', respectively. The 36' to 44' concentric circles are used for polar alignment in northern hemisphere using Polaris. While the 60' to 70' circles are used for polar alignment in southern hemisphere using Sigma Octantis.

5. Release R.A. Clutch Screw. Press the LFTT or RIGHT button on the hand controller to rotate the polar scope to align the 12 o'clock position of the dial on the top, as shown in **Figure 19**. (Or align to the zero position mark on the R.A. unit as shown in **Figure 20**). You may press number 9 button to change the rotation speed to MAX.

6. Make sure that the time and site information of the hand controller is correct. Press the **MENU** button, then select "**Align**" and "**Pole Star Position**" to display the current Polaris position. For example, on May 30, 2010, 20:00:00 in Boston, United States (Lat N42º30'32" and Long W71º08'50", 300 min behind UT, DST set to Y), the Polaris Position is 1hr 26.8m and r = 41.5m, as shown in **Figure 21** (a).

7. Adjust the mount in altitude (latitude) and azimuth (heading) direction to place Polaris in the same position on the Polar Scope Dial as indicated on the HC LCD. In this case, the Polaris will be located at a radius of 41.5' and an angle of 1 hour 26.8 minute, as shown in **Figure 21** (b).

(a)   (b)
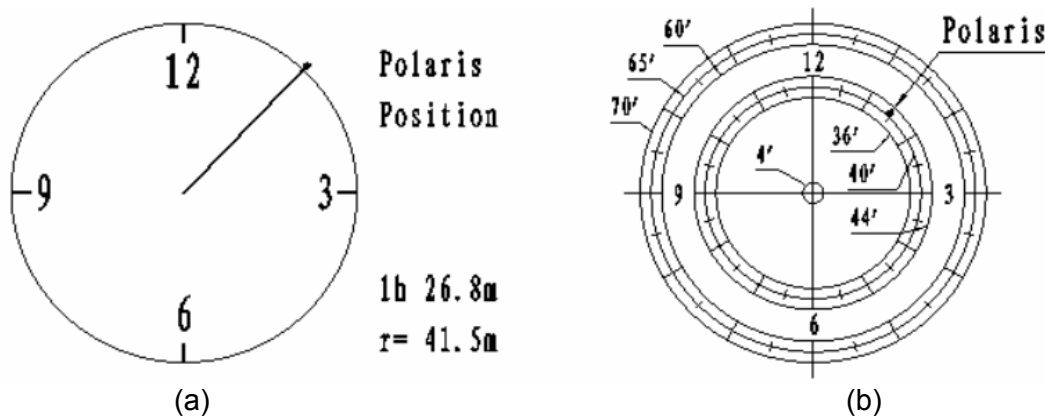
Figure 21. Place the Polaris at the position as shown on hand controller

You need to loose Azimuth Lock a little and use Azimuth Adjustment Knobs to adjust the mount in azimuth (heading) direction (**Figure 22**). Unlock Latitude Clutch, and turn Latitude Adjustment Screw or push the mount down to adjust the altitude (latitude), as shown in **Figure 23**. Secure all the locks after the polar alignment is done.

Now the mount is polar aligned.

Figure 22. Azimuth adjustment
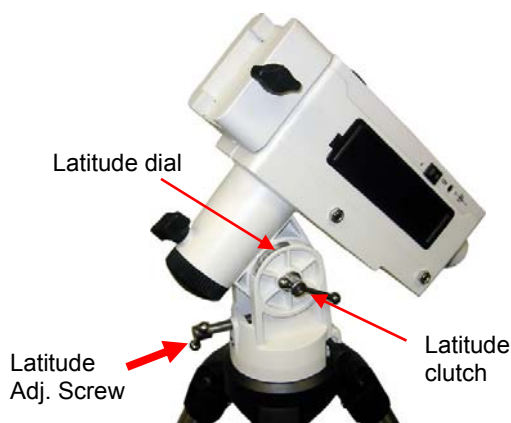
Figure 23. Latitude Adjustment

4.1.2. Adjust Polar Scope Focuser

If the polar scope does not focus on the distant object, take the polar scope out of the mount housing. Point the polar scope to a far distant object. Adjust the Objective Lens by turning the tube to get a clear image. Tune the lock ring to secure it.

Replace the Polar Scope back to the mount and tighten it. Adjust the Eyepiece to get a clear picture of the reticle.

4.1.3. BrightStar Polar Alignment

For those who do not have a polar scope, take off the Polar Axis Cover and Polar Scope Cover. Look through the polar scope opening to locate the Polaris. Slightly turn Azimuth Lock to loosen the mount head. Adjust the Azimuth Adjustment Knobs to do a fine adjustment of the mount to center the pole star in the azimuth direction. Tighten the Azimuth Adjustment Lock to secure the mount. Slightly loosen Latitude Clutch on the side of the mount, turning the Latitude Adjustment Screw to adjust the latitude (altitude). Re-tighten the locking screws. Use the **BrightStar Polar Alignment** procedure below to further align the mount.

(1) Level the SmartEQ mount and set it at Zero Position. Make sure the telescope is parallel to the pole axis (R.A. axis) of the mount. If a finder scope is used, adjust it to be parallel to the telescope optical axis. Turn the mount power on. Set correct R.A. and DEC backlash numbers. An eyepiece with cross hairs is recommended.

(2) Pressing the **MENU** button, then select "***Align***" and "***Polar Align***". The HC will display the azimuth and altitude position of several bright stars near meridian. Select one that is visible with high altitude as Alignment Star A. Follow the HC instruction to move the Star A to the center of the eyepiece with the combination of Latitude Adjustment Knob and "◄" or "►" button. Press ENTER to confirm. Next, select a bright star that is close to the horizon as the Alignment Star B. Center it using the Azimuth Adjustment Knob and "◄" or "►" button *(The "▲" and "▼" buttons are not used here)*. Press ENTER to confirm.

(3) The telescope will now slew back to Star A to repeat above steps. The iteration can be stopped when it is determined that the alignment error is at the minimum. Press **BACK** button to exit alignment procedure.

NOTE: It is highly recommended to use an eyepiece with crossed-hair line for accurate centering.

NOTE: The movement of the alignment star in your eyepiece may not be perpendicular but crossed, depends on its location in the sky.

If the pole star cannot be seen, you can use this BrightStar Polar Alignment procedure after set the mount to face North (or South) with correct latitude.

4.2. Manual Operation of the Mount

4.2.1. Manual Operation using a Hand Controller

You may observe astronomical objects using the arrow keys of a Go2Nova® hand controller.

Flip the I/O switch on the telescope mount to turn on the mount. Use ►,◄,▼ or ▲ buttons to point the telescope to the desired object. Use the number keys to change the slewing speed. Then press **0** button to start tracking.

4.2.2. Manual Operation without a Hand Controller

If you forget bring the hand controller with you or hand controller is under service, you still can use the mount to tracking the celestial object.

Without plug in the hand controller, the mount will start to tracking when the power switch is turned ON. Loosen R.A. and DEC clutches (**Figure 12**), manually push the telescope in R.A. and DEC to desired observing target, and retighten the R.A. DEC clutches. It is done.

4.3. Setting Up the Hand Controller

You need manually enter the time and site information before the mount can precisely go to an object.

4.3.1. Set Up Time and Site

Press MENU button, from the main menu, scroll down and select "***Set Up Controller***"

```
Select and Slew
Sync. to Target
Set Up Controller
Align
```

Press ENTER and select "Set Up Time and Site"

```
Set Up Time & Site
Set Display & Beep
Set Anti-backlash
Meridian Treatment
```

Press ENTER. A time and site information screen will be displayed:

```
2012-03-22 12:01:36     Y
300 Min. behind    UT
W071d08m50s
N42d30m32s         Northern
```

Local Time Set

Use the ◄ or ► key to move the cursor ▂ and use number keys to change the numbers. Use the ▲ or ▼ button to toggle between "Y" and "N" for Daylight Saving Time. Hold on the arrow key to fast forward or rewind the cursor.

In order to make hand control reflect your correct local time, time zone information has to be entered. Press ◄ or ► key, move the cursor to the second line "300 Min. behind UT" to set the time zone information (add or subtract 60 minutes per time zone). Enter minutes "ahead of" or "behind" UT (universal time). For Example,

- Boston is 300 minutes "behind" UT
- Los Angeles is 480 minutes "behind" UT
- Rome is 60 minutes "ahead of" UT
- Beijing is 480 minutes "ahead of" UT
- Sydney is 600 minutes "ahead of" UT

All the time zones in North America are *behind* UT, as shown in the following table. So make sure it shows "behind" instead of "ahead of" UT.

Time Zone	Hawaii	Alaska	Pacific	Mountain	Central	Eastern
Hour behind UT	-10	-9	-8	-7	-6	-5
Enter Minutes	600	540	480	420	360	300

To adjust minutes, move the cursor to each digit and use the number keys to input number directly. To change the "behind" or "ahead of" UT, move the cursor to "ahead" and using ▲ or ▼ key to toggle between "behind" and "ahead of". When the number is correct, press ENTER and go back to the previous screen.

For other parts of the world you can find your "time zone" information from iOptron website (http://www.ioptron.com/support.cfm?module=faq#). **DO NOT COUNT DAYLIGHT SAVING TIME**. Fraction time zone can be entered as well.

Observation Site Coordinate Set

The third and fourth lines display the longitude and latitude coordinates, respectively. "W/E" means western/eastern hemisphere; "N/S" means northern/southern hemisphere; "d" means degree; "m" means minute; and "s" means second.

The site coordinates information can be found from your GPS navigator, a GPS capable cell phone, or from internet, such as at *Support* section in iOptron website, under *Controller Set-up* (http://www.ioptron.com/support.cfm?module=faq#). By entering the city name or address, you can find its latitude and longitude. In case you only find the site information in decimal format you can convert them into d:m:s format by multiplying the decimal numbers by 60. For example, N47.53 can be changed to N47°31'48": 47.53° = 47° +0.53°, 0.53°=0.53x60'=31.8', 0.8'=0.8x60"=48". Therefore, 47.53°=47°31'48" or 47d31m48s.

Press ◄ or ► key to move the cursor and using ▲ or ▼ key to toggle between "W" and "E", "N" and "S", using number key to change the numbers. It is always a good idea to do your home work to get the GPS coordinates before traveling to a new observation site.

N/S Hemisphere Selection

If the polar axis is aligned to North Celestial Pole, then set the mount to Northern Hemisphere. If the polar axis is pointing to South Celestial Pole, set the mount to Southern Hemisphere. Press ◄ or ► key to move the cursor and using ▲ or ▼ key to toggle between "Northern Hemisphere" and "Southern Hemisphere".

Select Northern Hemisphere if you are located in US and press ENTER to go back to the main menu.

The time and site information will be stored inside the HC memory chip. If you are not traveling to another observation site, they do not need to be changed.

4.3.2. Initial Star Alignment

Perform a simple star alignment/synchronization after set up the hand controller to correct any pointing discrepancy of the Zero Position and to improve the GOTO accuracy.

To perform "*One Star Align*," press MENU button, scroll down to "*Align*", select "*One Star Align*" and press ENTER. The screen will display a list of bright objects for you to select from. Select an object using ▲ or ▼ key. Then press ENTER. After the mount slews to the target, use the arrow keys to center it in your eyepiece. Then press ENTER. (More align details in 5.6)

An alternate way is to perform "*Sync to Target*." Press the MENU button, select "*Select and Slew*" and press ENTER. Browse over the catalogs and select an object, such as "*Stars*" →"*Named stars*" →*140 (Polaris)*, and press ENTER. After the mount slews to Polaris, press the MENU button, scroll down to "*Sync. To Target*", follow the on-screen instruction to center Polaris and press ENTER. You may need to use the number keys to change the slewing speed to make the centering procedure easier.

4.3.3. Go to the Moon and Other Stars

After performing these set-ups the mount is ready to GOTO and track objects. One of the most common objects is the Moon.

To slew to the Moon press the MENU button. Select "**Select and Slew**" by pressing the ENTER button. Select "**Solar System**", and use the ▲ or ▼ buttons to select Moon. Press ENTER. The telescope will automatically slew to the Moon and lock on it. It will automatically begin to track once it locks on. If the Moon is not centered in your eyepiece, use the arrow keys to center the Moon. Or for better performance use "**Sync to Target**."

You may also select other bright celestial objects to start with, such as Jupiter or Saturn.

4.3.4. Star Identifying Function

The 8408 hand controller has a star identifying function. After **Polar Alignment** and **Set Up Time and Site**, slew the telescope to an bright star, manually or using GOTO. Press **?** (Help) button to identify the star name telescope is pointing to, as well as nearby bright stars if there are any.

4.4. Autoguiding (Only for SmartEQ^{TM} Pro Mount)

The SmartEQ^{TM} Pro mount equipped with an ST-4 autoguiding port. Connecting your guiding camera ST-4 cable to the port and refer to your guiding software to autoguide the mount.

4.5. Turn Off the Mount

When you have finished your observation, just simply turn the mount power off and disassemble the mount and tripod.

5. Complete Functions of Go2Nova® Hand Controller

5.1. Slew to an Object

Press the MENU button. From the main menu select "**Select and Slew**." Select an object that you would like to observe and press the ENTER key.

The Go2Nova® 8408 hand controller has a database of over 50,000 objects. Use the ► or ◄ buttons to move the cursor. Use the number buttons to enter the number, or the ▼ or ▲ buttons to change the individual number. Hold on a button to fast scroll through the list. The "⌂" indicates the object is above the horizon, and a cross mark "⌂" means it is below the horizon. In some catalogs those stars below the horizon will not display on the hand controller.

5.1.1. Solar System

There are 9 objects in the Solar system catalog.

5.1.2. Deep Sky Objects

This menu includes objects outside our Solar system such as galaxies, star clusters, quasars, and nebulae.

- Named Objects: consists of 60 deep sky objects with their common names. A list of named deep sky objects is included in Appendix E.

- Messier Catalog: consists of all 110 Messier objects.

- NGC IC Catalog: consists of 7,840 objects in NGC catalog and 5,386 objects in IC catalog. To select an object from NGC or IC catalog, move the cursor to NGC, using ▲ or ▼ button to toggle between NGC and IC. Then move the cursor to a numerical position and use the number button to select the object.

- UGC Catalog: consists of 12,921 objects.

- Caldwell Catalog: consists of 109 objects.

- Herschel Catalog: consists of 400 objects.

5.1.3. Stars:

- Named Stars: consists of 195 stars with their common names. They are listed alphabetically. A list is included in Appendix E.

- Binary Stars: consists of 210 binary stars. A list is attached in Appendix E.

- GCVS: consists of 5,553 bright variable stars in the catalog.

- SAO Catalog: consists of 26,584 bright SAO catalog objects. They are listed numerically.

5.1.4. Constellations

This catalog consists of 88 modern constellations with their names. They are listed alphabetically. A list is attached in Appendix E.

5.1.5. Comets

This catalog contains 15 comets.

5.1.6. Asteroids

This catalog contains 116 asteroids.

5.1.7. User Objects

It can store up to 60 used entered objects.

5.1.8. Enter R.A. DEC

Here you can go to a target by entering its R.A. and DEC numbers.

5.2. Sync to Target

This operation will match the telescope's current coordinates to Target Right Ascension and Declination. After slewing to an object, press MENU—then scroll to "*Sync to Target*" and press ENTER. Follow the screen to do the sync. Using this function will re-calibrate the computer to the selected object. Multiple syncs can be performed if needed. This operation is most useful to find a faint star or nebula near a bright star.

"*Sync to Target*" will only work after "*Select and Slew*" is performed. You can change the slewing speed to make the centering procedure easier. Simply press a number (1 through 9) to change the speed. The default slew speed is 64X.

"*Sync to Target*" does the same thing as one star alignment except that you choose the object to "sync" to. "*One star align*" chooses the star/object for you.

5.3. Set Up Controller

5.3.1. Set Up Time & Site

Refer to 4.3.1.

5.3.2. Set Display & Beep

Press MENU button, from the main menu, scroll down and select "*Set Up Controller*". Press ENTER and select "*Set Display and Beep*":

```
Set Up Time & Site
Set Display & Beep
Set Anti-backlash
Meridian Treatment
```

Use arrow keys to adjust LCD display contrast, LCD backlight intensity, keypads backlight Intensity and turn the keep beep ON/OFF

5.3.3. Set Anti-backlash

All mechanical gears have a certain amount of backlash or play between the gears. This play is evident by how long it takes for a star to move in the eyepiece when the hand control arrow buttons are pressed (especially when changing directions). The Go2Nova anti-backlash feature allows user to compensate for backlash by inputting a value which quickly rewinds the motors just enough to eliminate the play between gears.

To set the anti-backlash value, scroll down and select "Set Anti-backlash"

```
Set Up Time & Site
Set Display & Beep
Set Anti-backlash
Meridian Treatment
```

Press ENTER. A R.A. anti-backlash screen will display:

20

```
R.A. anti-backlash:
          0000      steps
One step equals to
0.6 arc second.
```

To adjust steps move the cursor to each digit and use the number keys to input number directly. Press ENTER – "DEC anti-backlash" will display:

```
DEC anti-backlash:
          0000      steps
One step equals to
0.6 arc second.
```

Move the cursor to each digit and use the number keys to set the anti-backlash. Press ENTER to go back the previous screen. Press BACK button to go back to main menu.

While viewing an object in the eyepiece, observe the responsiveness of each of the four arrow buttons. Note which directions you see a pause in the star movement after the button has been pressed. Working one axis at a time, adjust the backlash settings high enough to cause immediate movement without resulting in a pronounced jump when pressing or releasing the button. The hand controller will remember these values and use them each time it is turned on until they are changed.

5.3.4. Meridian Treatment

This function tells mount what to do when it tracks across the meridian. There are three options. **Stop Tracking** will stop the mount when it passes the meridian. **Telescope Flip** will flip the telescope and continuous to track the object. The third option is **Continue to Track**. In this case, the mount will keep tracking and the OTA could hit the tripod leg if the mount is not monitored.

5.3.5. Track Below Horizon

This function allows mount to keep tracking an object even it is below horizon but still can be seen from an elevated observation site, such as at a hill. The power on default is at OFF state. One can turn it on when needed.

5.3.6. Set Polar Light

Use this function to adjust the light intensity of the LED that used for a polar scope. Set the LED light intensity at the minimum when there is no polar scope is installed.

5.3.7. Firmware Information

This option will display firmware version information of hand controller, R.A. control board and DEC control board.

5.4. Align

This function is used for aligning the telescope. The system provides three alignment methods: "One Star Align", "Two Star Align" and "Three Star Align". The mount has to be at Zero Position before performs any star alignment.

5.4.1. One Star Alignment

This function is used for aligning the telescope. The hand controller provides "Polar Align", which uses a set of 2 bright stars for polar alignment. This provides a viable polar alignment approach for those who can't see the polar star or has a mount does not equip an iOptron AccuAlign[TM] polar scope. The system also provides three alignment methods: "SolarSys Align", "One Star Align", and "Multi-Star Align". The mount has to be at Zero Position before performing any star alignment.

5.4.2. Polar Alignment

Press the MENU button, then select "**Align**" and "**Polar Align**". The HC will display the azimuth and altitude position of several bright stars near meridian. Select one that is visible with high altitude as Alignment Star A. Follow the HC instruction to move the Star A to the center of the eyepiece with the combination of Latitude Adjustment Knob and "◄" or "►" button. Press ENTER to confirm. Next, select a bright star that is close to the horizon as the Alignment Star B. Center it using the Azimuth Adjustment Knob and "◄" or "►" button (*The "▲" and "▼" buttons are not used here*). Press ENTER to confirm.

The telescope will now slew back to Star A to repeat above steps. The iteration can be stopped when it is determined that the alignment error is at the minimum. Press BACK button to exit alignment procedure.

NOTE: It is highly recommended to use an eyepiece with crossed-hair line for accurate centering.

NOTE: The movement of the alignment star in your eyepiece may not be perpendicular but crossed, depends on its location in the sky.

5.4.3. SolarSys Alignment

Press MENU button and select "**Align**". Select "**SolarSys Align**" and press ENTER for available alignment object.

5.4.4. One-Star Alignment

Press MENU button and select "**Align**". Select "**One Star Align**" and press ENTER. A list of alignment stars that are above the horizon is computed based on your local time and location. With the mount at the "Zero Position," use ▲ and ▼ buttons to select a star and press ENTER. Center the target in your eyepiece using arrow key. Press ENTER when finished. If your mount is well set up and polar aligned, one star alignment should be sufficient for good GOTO accuracy. To increase the accuracy you may choose to do multi star alignment.

5.4.5. Multi-Star Alignment

With iOptron's multi-star alignment, you can choose two, three, or as many stars as you want to reduce the mount alignment offset.

Press MENU button and select "**Align**". Select "**Multi-Star Align**" in the align menu. A list of alignment stars that are above the horizon is computed based on your local time and location. With the mount is at the "Zero Position," use ▲ and ▼ buttons to select first alignment star and press ENTER. Center the target in your eyepiece using arrow key. Press ENTER when finished. The hand controller will prompt you to choose the second star. If the star you choose is too close to the first one, the system will let you choose another one. When you are aligned with the second star, the two star alignment is finished. You can reject the suggested star if it is blocked by a tree or other obstruction.

If you've done with the two star alignment, press the BACK button to finish the alignment. Press ENTER key to select third star for further alignment.

5.4.6. Pole Star Position

This shows Polaris position in northern hemisphere or Sigma Octantis position in southern hemisphere.

5.5. Set User Objects

Besides various star lists available in the hand controller --you can add, edit or delete your own user-defined objects. You can also add your favorite observation object into the user object list for easy sky surfing. Up to 60 user objects can be stored here.

To set user objects, press MENU button, from the main menu, scroll down and select "**Set User Objects**"

```
Sync to Target
Set Up Controller
Align
Set User Objects
```

Press ENTER to bring up **Set User Objects** screen.

```
Add a New Record
Browse Records
Delete One Record
Delete All Records
```

Select "**Add a New Record**" from Set User Objects screen. A screen will display asking to **Enter R.A. DEC**:

```
 Enter R.A. DEC
 R.A.:  00h00m00s
 DEC:  +00d00m00s
```

You may enter the R.A. and DEC coordinates of the star you want to watch, and press ENTER. A confirmation screen will show. Press ENTER to confirm storing your object under assigned user object number, or press BACK button to cancel it.

A more useful application of this function is to store your favorite viewing objects before heading to the filed. When "**Add a New Record**" screen shows, press the MENU button, it brings up the star catalogs that you can select the star from. Follow the screen to add your favorite objects. Press BACK button to go back one level.

Press BACK button few times to go back to **Set User Objects.** You may review the records or delete the ones you don't want it anymore. Press BACK button to finish the operation. Now you can slew to your favorite stars from **User Objects** catalog using "**Select and Slew**."

5.6. To Zero Position

This moves your telescope to its Zero Position (refer to **Figure 13**). When the power is turned on, the mount assumes the Zero Position. This is its reference point for all other objects being tracked.

6. Maintenance and Servicing

6.1. Maintenance

The SmartEQ^{TM} mount is designed to be maintenance free. Do not overload the mount. Do not drop the mount, this will damage the mount or degrade the GOTO tracking accuracy permanently. Use a wet cloth to clean the mount and hand controller. Do not use solvent.

If your mount is not to be used for an extended period, dismount the OTAs and counterweight(s).

6.2. iOptron Customer Service

If you have any question concerning your SmartEQ^{TM} mount, contact iOptron Customer Service Department. Customer Service hours are 9:00 AM to 5:00 PM, Eastern Time, Monday through Friday. In the unlikely event that the mount requires factory servicing or repairing, write or call iOptron Customer Service Department first to receive an RMA# before returning the mount to the factory. Please provide details as to the nature of the problem as well as your name, address, e-mail address, purchase info and daytime telephone number. We have found that most problems can be resolved by e-mails or telephone calls. So please contact iOptron first to avoid returning the mount for repair.

It is strongly suggested that to send technical questions to support@ioptron.com, or call in the U.S. 1.781.569.0200.

6.3. Product End of Life Disposal Instructions

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle/disposal service or the product representative.

6.4. Battery Replacement and Disposal Instructions

Battery Disposal- Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where you can drop off your waste battery for recycling, please contact your local waste disposal service or the product representative.

Appendix A. Technical Specifications

Mount	German Equatorial Mount
Payload	11 lbs (5kg), exclude counterweight
Mount weight	6.2 lbs (2.8kg)
Latitude adjustment range	0º ~ 65º
Azimuth adjustment range	± 10º
Right Ascension worm wheel	Φ60mm, 120 teeth
Declination worm wheel	Φ60mm, 120 teeth
Right Ascension axis shaft	Φ25mm steel
Declination axis shaft	Φ25mm steel
Right Ascension bearing	Φ42mm
Declination bearing	Φ42mm
Motor drive	DC servo with optical encoder
Resolution	0.5 arc seconds
Hand Controller	Go2Nova® 8408 with 50,000 objects database
Tracking	Automatic
Speed	1×,2×,8×,16×,64×,128×,256×,512×,MAX(~4°/sec)
Counterweight shaft	Φ16mm
Counterweight	2 lbs (0.9kg)
Dovetail	VIXEN
Tripod	1.25" Stainless Steel (5.7lbs or 2.6kg)
Polar Scope	AccuAligning™ bright field illuminated Standard for SmartEQ™ Pro, Optional for SmartEQ™
Power consumption	0.1A(Tracking), 0.3A(GOTO)
Power requirement	DEC 9 ~12V, 1 amp
Battery	8AA (not included)
Serial port	Yes (on hand controller)
Autoguide port	ST-4 compatible (SmartEQ™ Pro only)
Firmware upgrade	Yes
PC computer control	Yes (ASCOM)
Warranty	One year limited

Appendix B. Go2Nova® 8408 HC MENU STRUCTURE

```
MENU
 │
 ├── Select and Slew
 │    │
 │    ├── Solar System
 │    │    ├── Mercury
 │    │    ├── Venus
 │    │    ├── Mars
 │    │    ├── Jupiter
 │    │    ├── Saturn
 │    │    ├── Uranus
 │    │    ├── Neptune
 │    │    ├── Sun
 │    │    └── Moon
 │    │
 │    ├── Deep Sky Objects
 │    │    ├── Named Object
 │    │    ├── Messier Catalog
 │    │    ├── NGC IC Catalog
 │    │    ├── UGC Catalog
 │    │    ├── Caldwell Catalog
 │    │    └── Herschel Catalog
 │    │
 │    ├── Stars
 │    │    ├── Named Stars
 │    │    ├── Binary Stars
 │    │    ├── GCVS
 │    │    └── SAO Catalog
 │    │
 │    ├── Constellations
 │    ├── Comets
 │    ├── Asteroids
 │    ├── User Objects
 │    └── Enter R.A. and DEC
 │
 ├── Sync. To Target
 │
 └── Set Up Controller
      ├── Set up Time & Site
      ├── Set Display & Beep
      └── Set Anti-backlash
```

```
                                      ┌─────────────────────┐
                            ──────────┤ Meridian Treatment  │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤ Track Below Horizon │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤   Set Polar Light   │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤ Firmware Information │
                                      └─────────────────────┘

           ┌──────────────────┐
   ────────┤      Align       │
           └──────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤     Polar Align     │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤    SolarSys Align   │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤    One Star Align   │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤   Multi-star Align  │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤  Pole Star Position │
                                      └─────────────────────┘

           ┌──────────────────┐
   ────────┤ Set User Objects │
           └──────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤  Add A New Record   │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤   Browse Records    │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤  Delete One Record  │
                                      └─────────────────────┘
                                      ┌─────────────────────┐
                            ──────────┤  Delete All Records │
                                      └─────────────────────┘
           ┌──────────────────┐
   ────────┤ To Zero Position │
           └──────────────────┘
```

Appendix C. Firmware Upgrade

The firmware of a Go2Nova® 8408 hand controller can be upgraded by the customer. Please check iOptron's website, www.iOptron.com, under Support Directory, for the most up to date firmware.

To upgrade the firmware, you need some or all of the following software/hardware, depends on the upgrading you are performing:

- iOptron Upgrade Utility Program
- 8408 hand controller firmware
- RJ9 serial port to RS232 cable
- USB to RS232 converter and driver. If your computer does not equip a RS232 port (9-pin D-shape connector) except the USB port, you need to buy a USB to RS232 converter, form a computer hardware store or on-line.

1. Prepare the hardware

In order to perform the firmware upgrade, as well as to use planetarium software to control the mount via a 8408 hand controller, the communication between the PC and hand controller or mount has to be established.

RJ9 to RS232 cable

The firmware upgrade and computer controller is through a RJ9 serial port on a Go2Nova® 8408 hand controller. You need a cable to connect this port to the serial port of a computer. Here is a sample of a RJ9 to RS232 serial cable. It is also available from iOptron online store (iOptron item# 8412).

If you are making your own cable, here is the wiring instruction:

Wiring	
RS232	RJ9
2	4
3	3
5	1

RS232 connector (female)   RJ9 plug
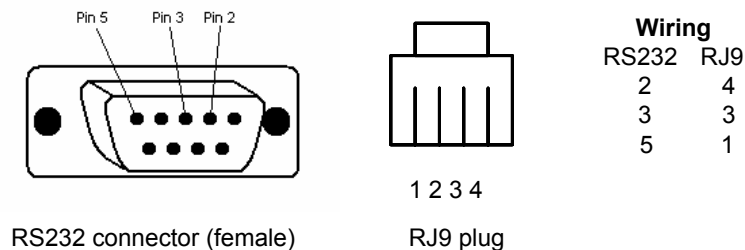
USB to RS232 converter

If you are using a computer only has USB ports, like most laptops do, you need a USB to COM converter to convert one USB port to a COM (RS232) port. Here are two examples of USB2COM converters. We recommend a converter with a Prolific PL2303 chip set.

2. Find the serial port (COM port) number from your computer:

The first step is to find the COM port number. If your computer has a serial port (9-pin D-shape male connector on the back, next to the 25 pin printer connector), the default assigned number is COM1.

If you are using a USB to COM converter to convert one USB port to a COM port, you can find the computer assigned COM port number.

After install the USB2COM driver that comes with the device, click on **Start** located on the left bottom corner of your compute screen. Move the mouse to **My Computer** and right click on it. Move the mouse down and click on **Properties.**
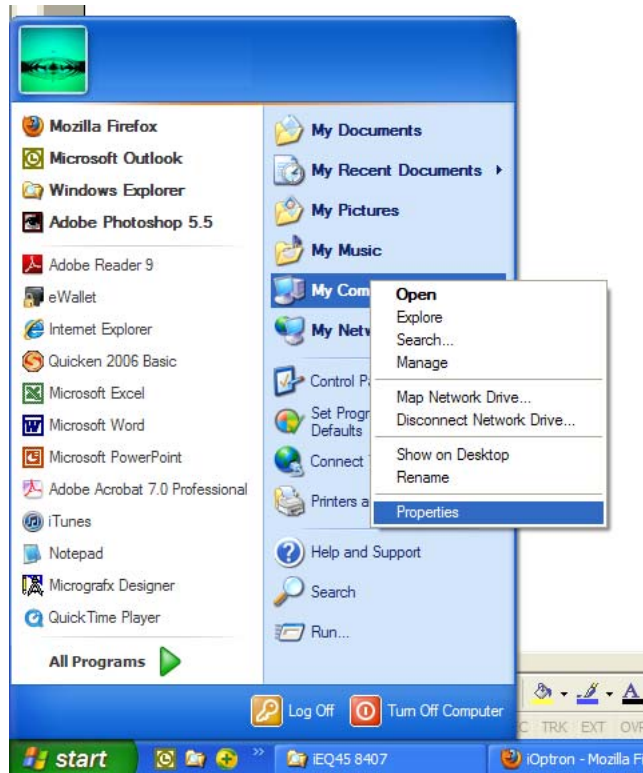
Click on **Hardware** and select **Device Manager**.
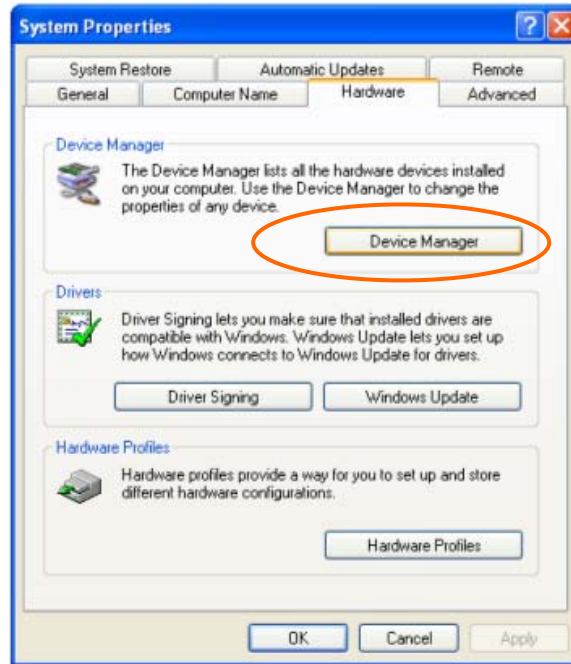
Double click on **Ports(COM & LPT),** find out the COM number and write it down (in the following figure, the USB2COM converter uses a Prolific chipset and the assigned port number is COM1)
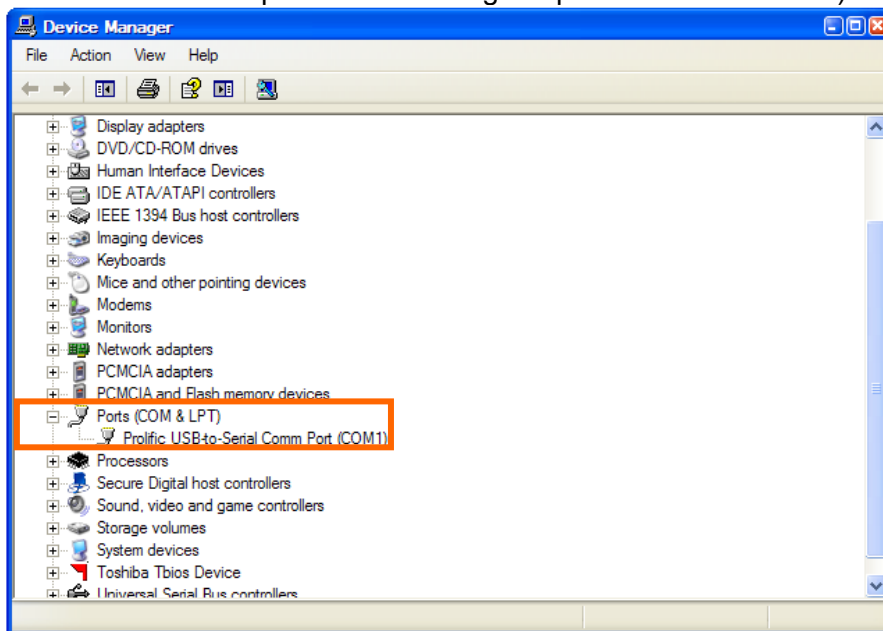
3. Download software and firmware from iOptron wbesite:

Go to iOptron website, www.iOptron.com, click on **Download** tab. Locate **iEQ Mount Firmware** under **Software/Firmware Upgrades** catalog on the left part of the screen, and click on it.

Download and save Upgrade Utility software and Go2Nova 8408 Hand Controller firmware.

4. Upgrade 8408 hand controller firmware:

(1) Connect 8408 hand controller to the HBX port of a SmartEQ mount. Make sure the mount power is OFF;

(2) Connect RJ9 plug into the serial port of a 8408 hand controller and the 9-pin RS232 connector to your computer's RS232 port (or RS232 port of the USB2COM converter);

(3) Hold **ENTER** button of the hand controller while switch the ON/OFF button to turn the mount power on;

(4) Locate download software and click on **Upgrade Utility.exe**:
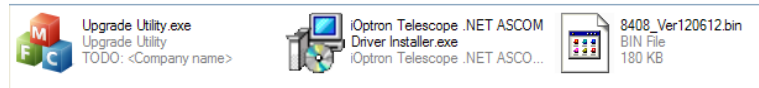
(5) An iOptron Upgrade Utility window will display. Click on **Browse**:
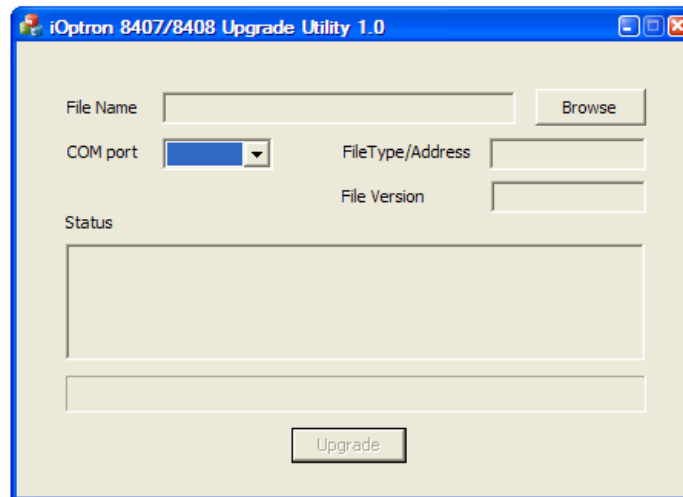
(6) Select hand controller firmware 8408_VerXXXXXX and click **Open**
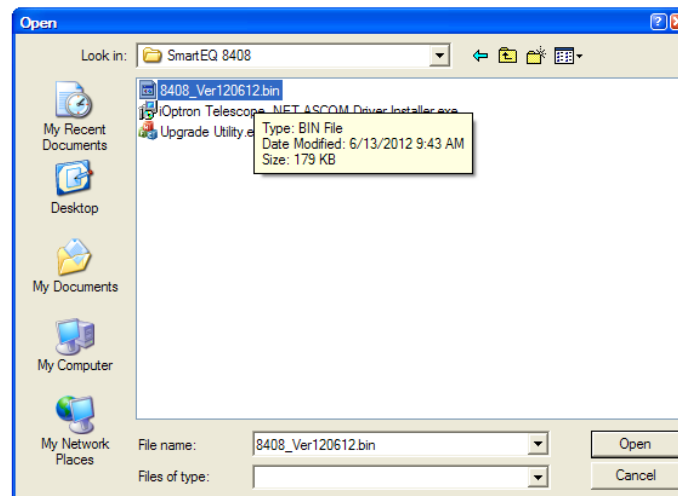
(7) The **FileType** and **Version** will be verified and displayed. Click on pull down menu of the COM port and select the COM port number. Here is **COM1**.
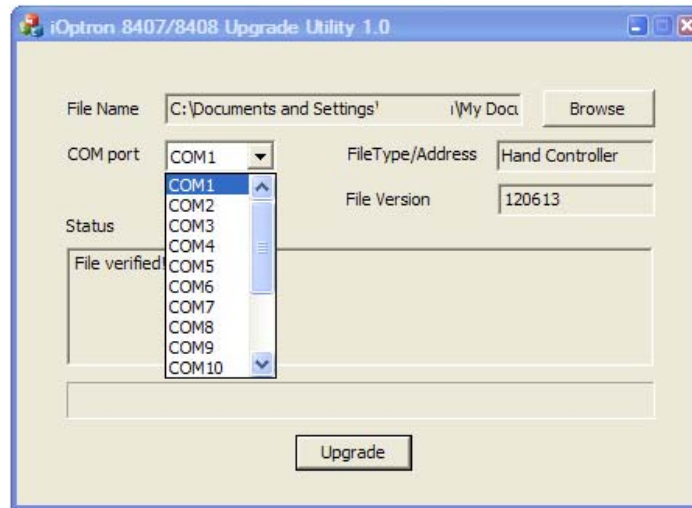
(8) Click on **Upgrade** button to start the process;
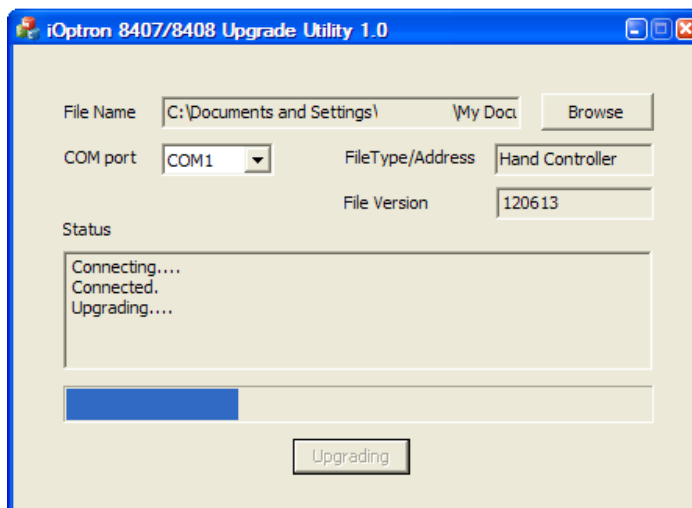
(9) After the firmware upgraded successfully, exit the Upgrade Utility program by click on ⊠.
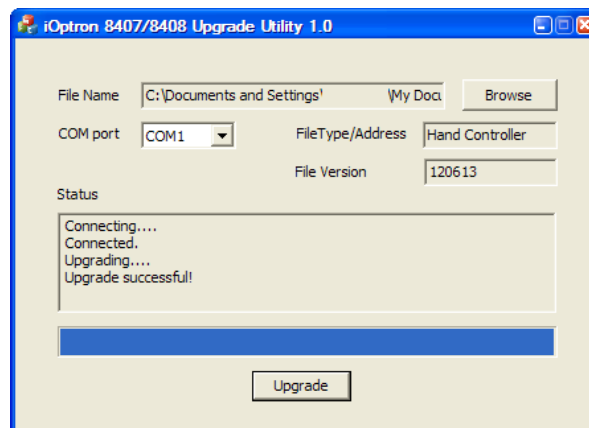
If the upgrade process was disrupted, wrong firmware is loaded, or the firmware does not successfully, just start over it again. Make sure a correct COM port is selected.

Appendix D. Computer Control an SmartEQ Mount

The SmartEQ mount can be connected to a computer using a RS232 cable via hand controller serial port. A RS232 to USB adapter (not included) is needed if your computer does not have a serial port, like most of the laptops on the market today. Follow the adapter instructions to install the adapter driver. A RJ9 serial port to RS232 cable (not included) is also need to connect the RS232 port to the HC serial port. Please refer to Appendix C for more information.

To control the mount via ASCOM protocol, you need:

- ASCOM Platform 6. Download and install it from http://www.ascom-standards.org.

- iOptron Telescope .NET ASCOM Drive. Download and install it from http://www.ioptron.com, under Support directory.

- Make sure you computer has Microsoft .NET Framework 3.5 SP1 or up I sinstalled.

- Buy/download planetarium software and install it.

When the communication between the hand controller and computer has been established by following **Step 1** and **Step 2** of Appendix C, the mount can be controlled via ASCOM protocol.

Establish the ASCOM connection between the mount and the planetarium software:

As a general instruction, a freeware planetarium software, _Cartes du Ciel_, is used as an example. Please refer to you own software manual for detailed operation.

1. Open _Cartes du Ciel_. Select **Telescope settings** in **Telescope** pull-down manual.
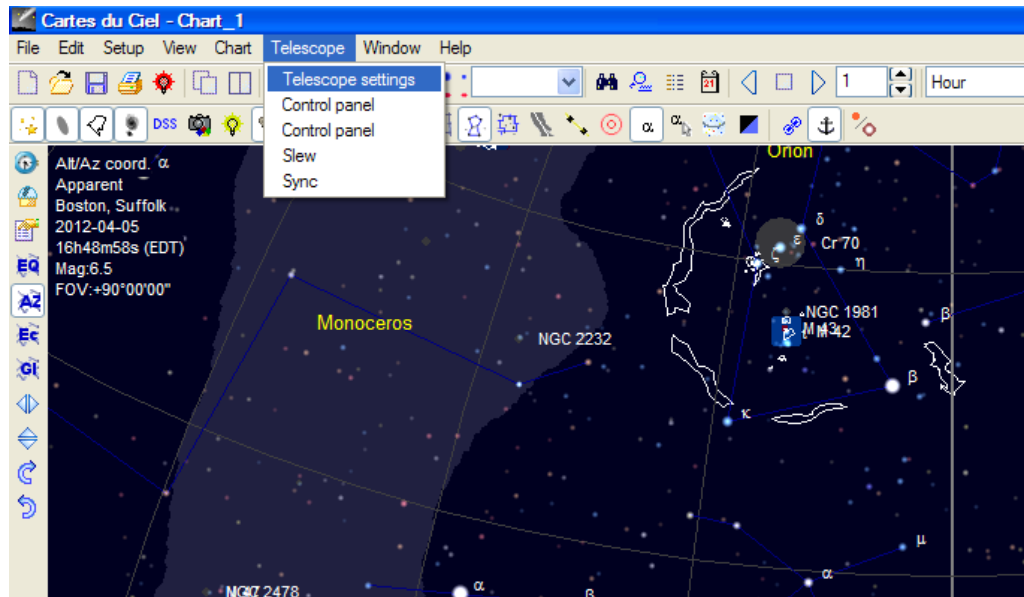
2. Select **ASCOM** as the telescope interface and click **OK**.
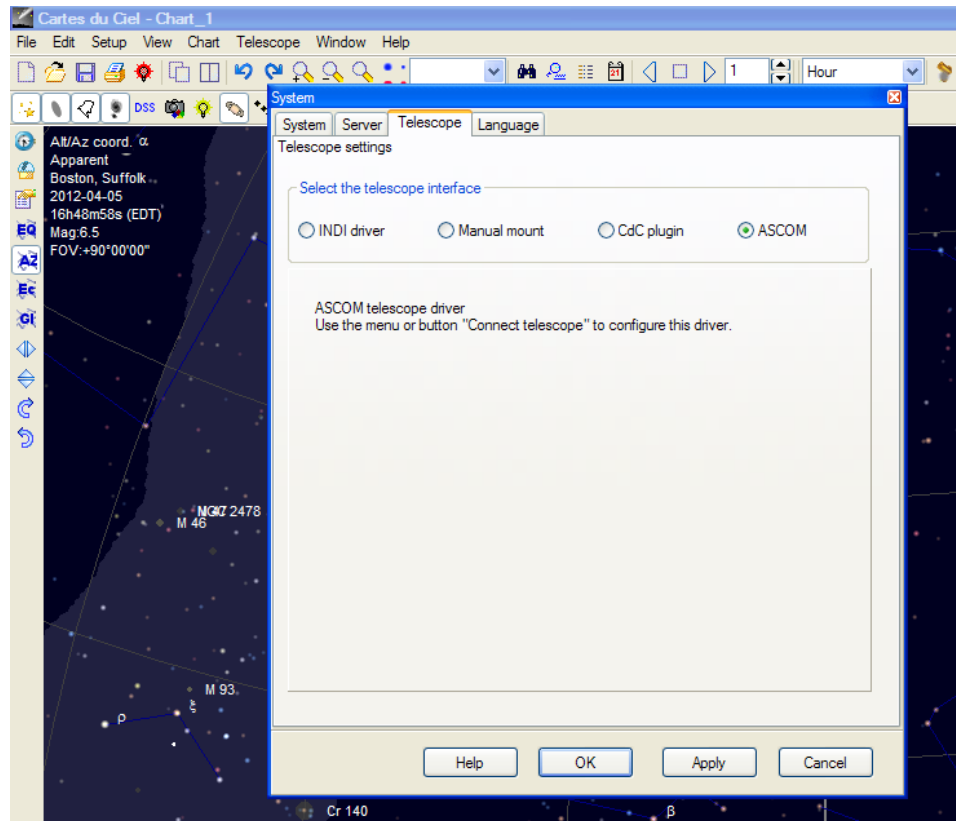
3. Select **Control panel** in **Telescope** pull-down manual.
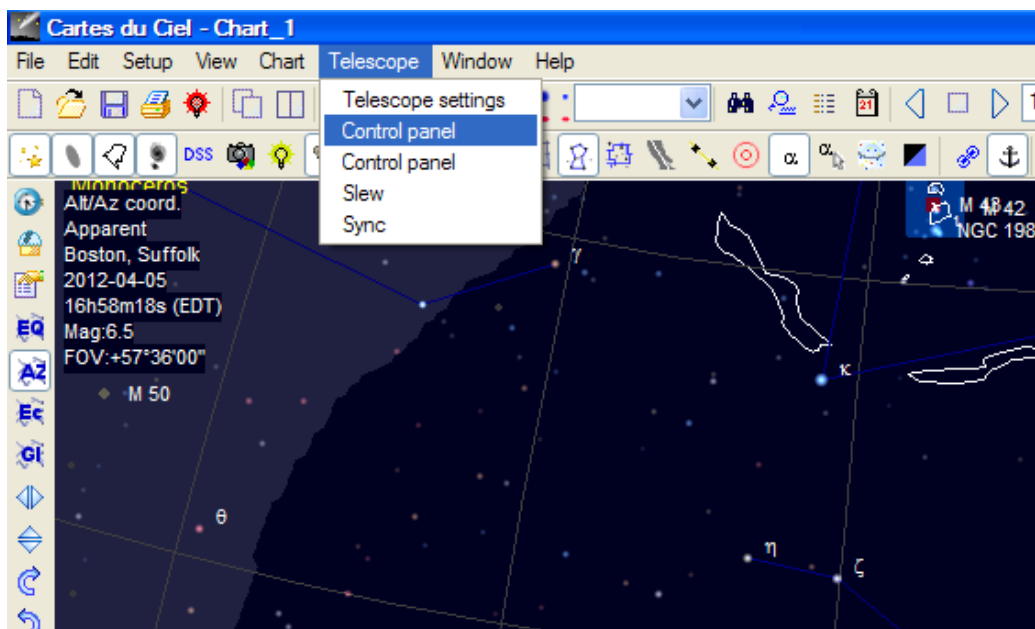
4. Click on **Select** button, an **ASCOM Telescope Chooser** window will pop-up. Click on the pull-down menu to select **iOptron Telescope .NET**, then click **OK**.
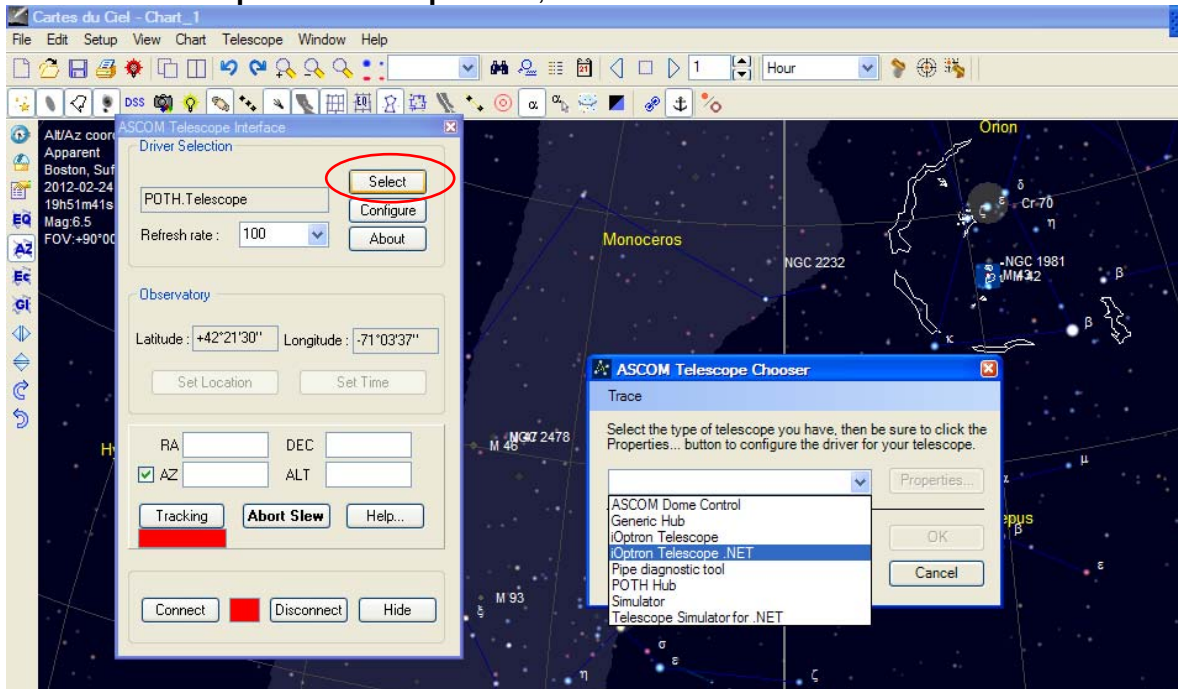
5. Click on **Configure**. In **iOptron Telescope ASCOM Driver Setup** pop-up window, select COM1 port from the **COM Port** pull-down menu. Click OK.
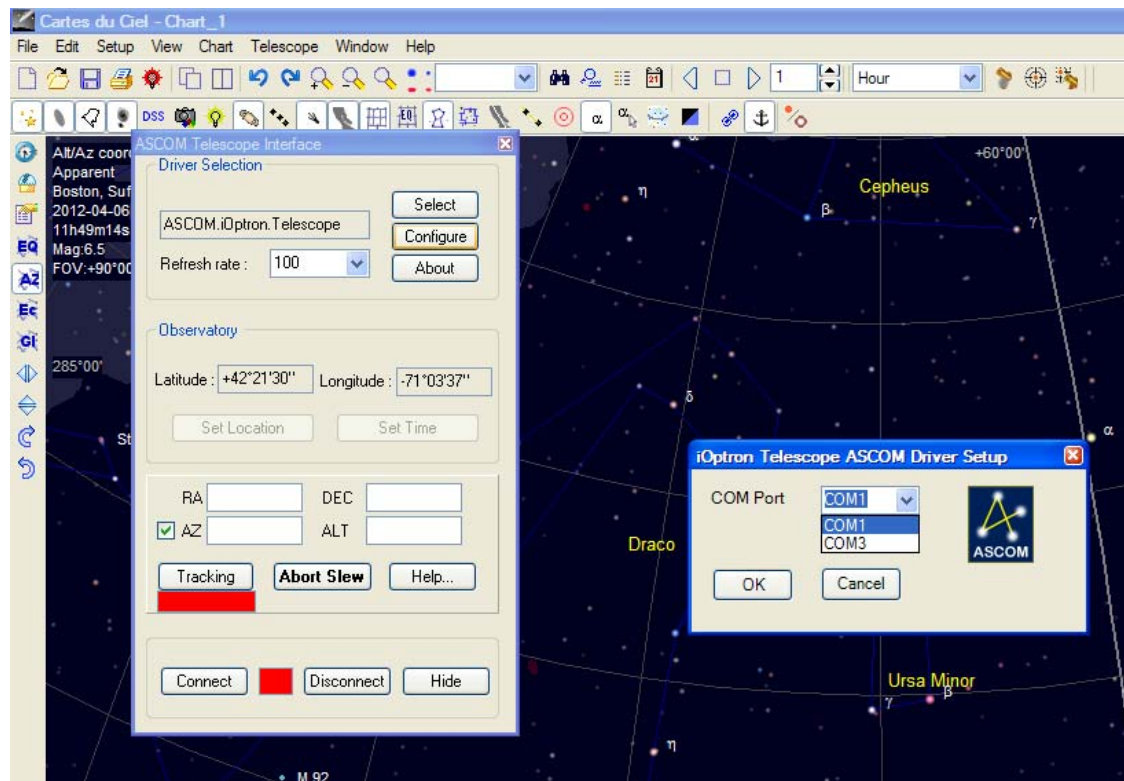
6. Click **Connect** button. The RED status square will change to GREEN. Now you are ready to GOTO and tracking.
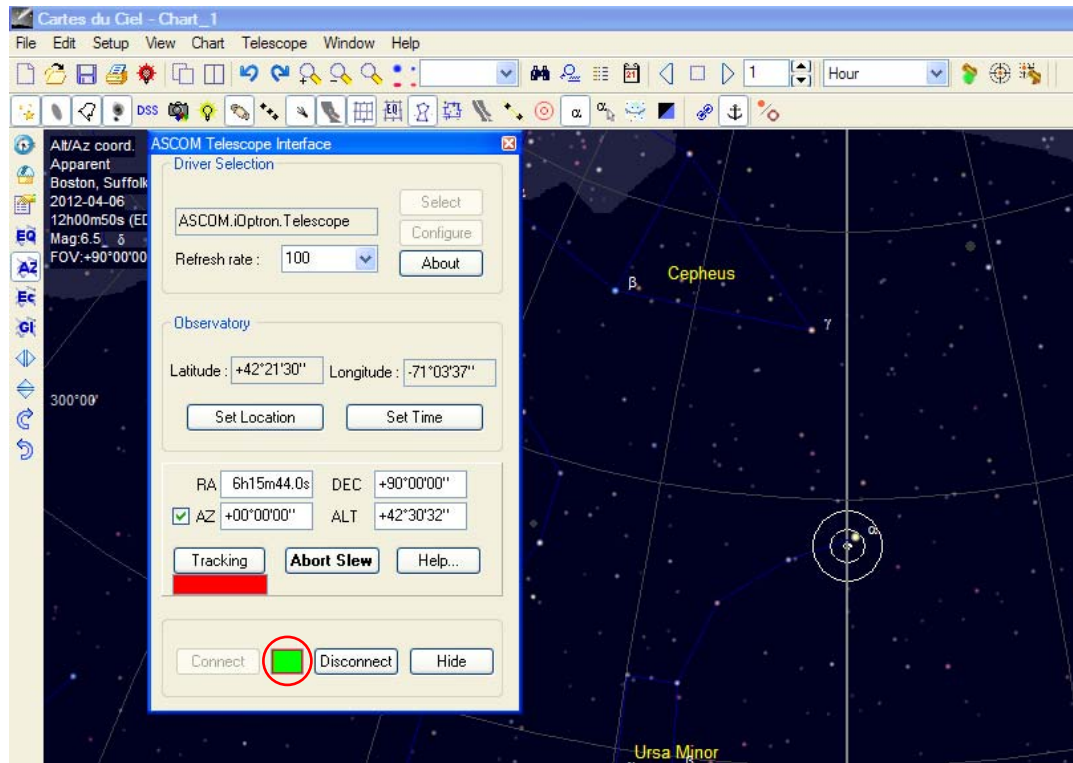
Appendix E. Polar Scope Adjustment

Reticle Adj. Screws

Eyepiece

Objective Lens

Locking Ring
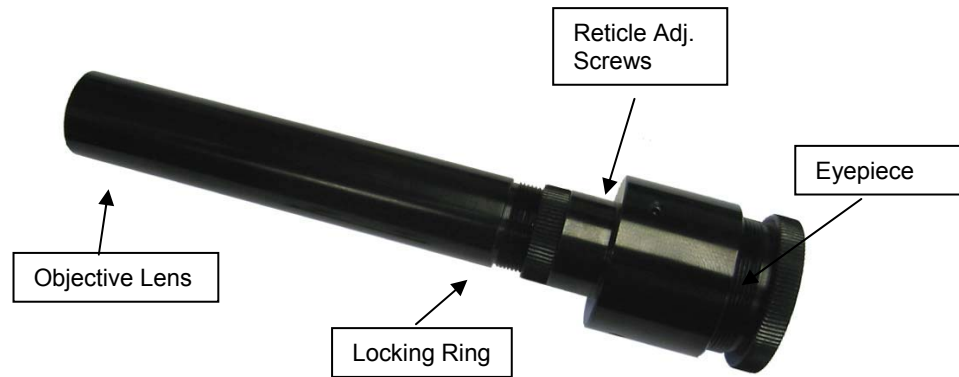
If you are suspecting that the polar scope may be misaligned to the mount R.A. axis, you may check it by putting a star in the center of the polar scope reticle cross hairs and rotating mount's R.A. axis. If the star stays in the center of cross hairs, the polar scope is aligned to the mount's R.A. axis.

In the event the polar scope optical axis needs to be adjusted, you can do this procedure at night while pointing at Polaris. However, it is probably easier to do it during the daytime using a distant point, such as a flag pole or top of a building a couple of hundreds away, as your target. Please remove the telescope, the counterweights and counterweight shaft from the mount. Aim the mount to the object. Use the Latitude Adjustment Screw and Azimuth Adjustment Knob to center the object.

1. Release RA Clutch Screws. Rotate the mount along the RA axis to the balance position, dovetail saddle on right side. Lock the RA clutch screws.
2. Loose latitude Locking Screws and Azimuth Locking Screws a little. Centering the object one the cross hairs by adjust Latitude Adjust. screw Azi. Adjust. Knob.
3. Release the RA clutch again. Rotate mount 180º to bring the dovetail to the side. Retighten the RA clutch screw. Bring the object half the distance to the center by adjusting the reticle adjustment set screws using a hex Keep in mind that the image in the finder is inverted. Loose one screw first, then tighten the other screw(s). Only loose/tighten one screw at a time and a few turns each time to avoid the reticle totally lost its position. It may take a few minutes to familiarize yourself with the screws that move the polar scope in the appropriate direction. **PLEASE do not over tighten the setting screws.**
4. Release the RA clutch and rotate the mount 180º to bring the dovetail back to the right side. If you are lucky enough, the object will stay in center of the polar scope. Otherwise, repeat Steps 2 and 3 to further move the object to the center.
5. After few times, the object will stay in center when the mount is flipped from right to left.

Center the object | Bring the object half the distance to the center

Rotate

Rotate
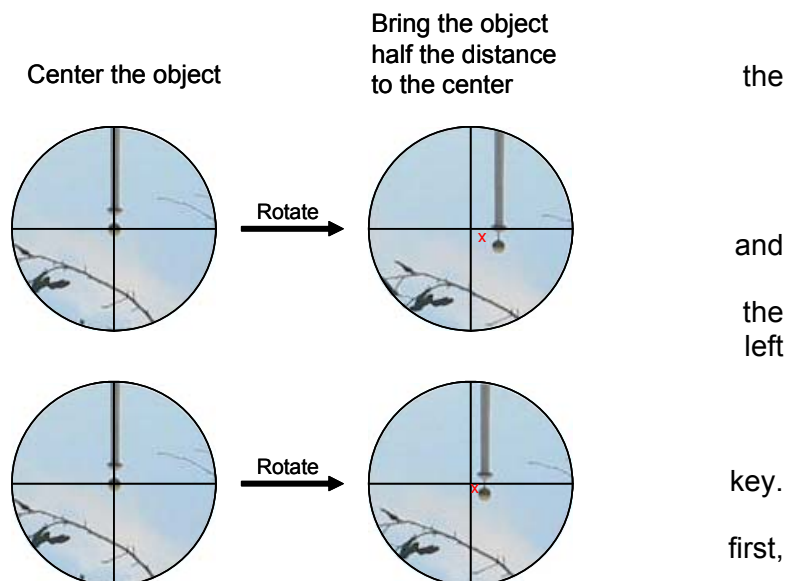
Appendix F. Go2Nova® Star List

Messier Catalog
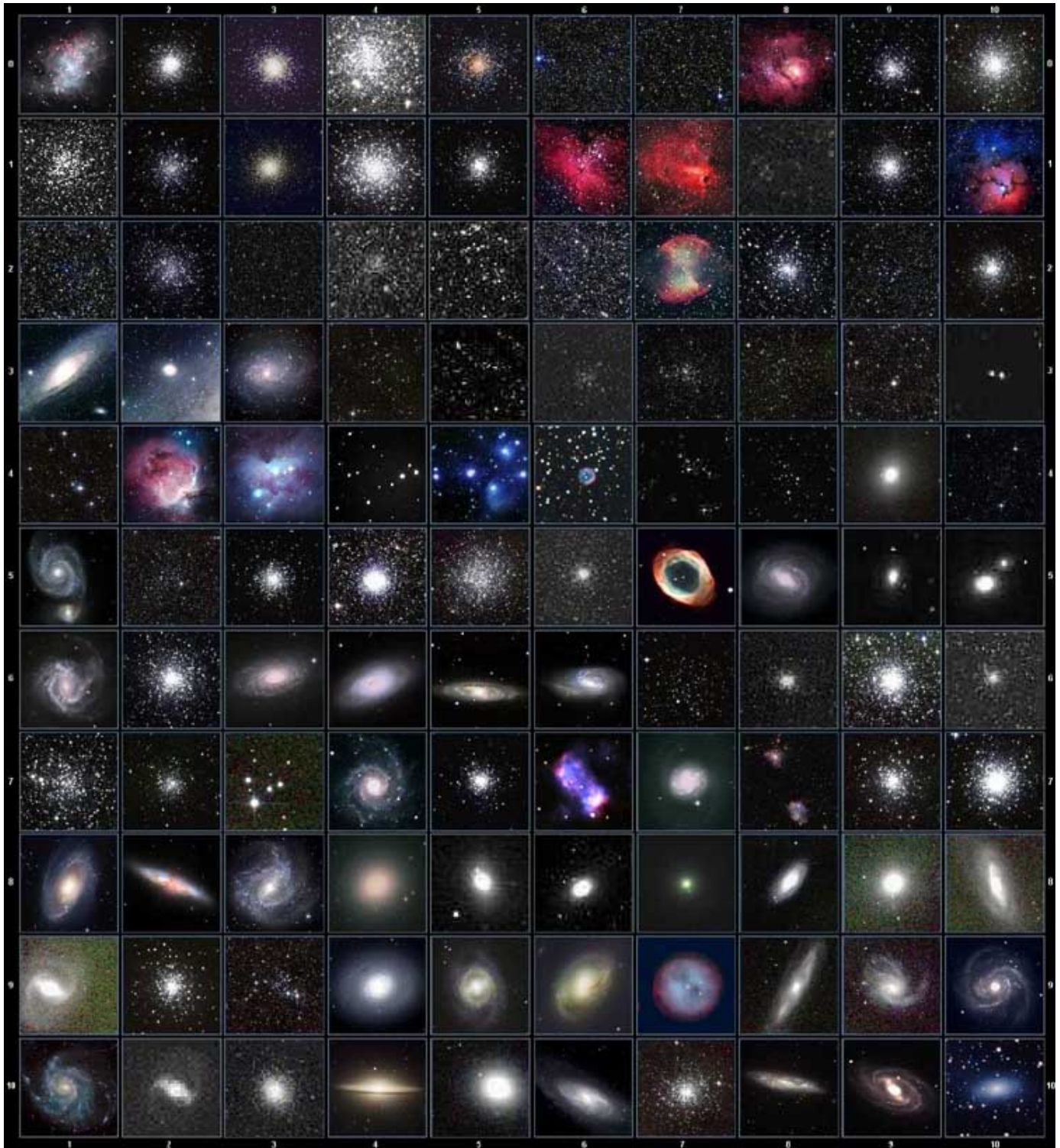
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Named Star List

001 Acamar	050 Asellus Australis	099 Kaus Media	148 Rastaba
002 Achernar	051 Asellus Borealis	100 Keid	149 Regulus
003 Acrux	052 Aspidiske	101 Kitalpha	150 Rigel
004 Acubens	053 Atik	102 Kochab	151 Rigel Kentaurus
005 Adhafera	054 Atlas	103 Kornephoros	152 Ruchbah
006 Adhara	055 Atria	104 Kurhah	153 Rukbat
007 Al Na'ir	056 Avoir	105 Lesath	154 Sabik
008 Albali	057 Azha	106 Maia	155 Sadachbia
009 Alberio	058 Baten Kaitos	107 Marfik	156 Sadalbari
010 Alchibar	059 Beid	108 Markab	157 Sadalmelik
011 Alcor	060 Bellatrix	109 Matar	158 Sadalsuud
012 Alcyone	061 Betelgeuse	110 Mebsuta	159 Sadr
013 Aldebaran	062 Biham	111 Megrez	160 Saiph
014 Alderamin	063 Canopus	112 Meissa	161 Scheat
015 Alfirk	064 Capella	113 Mekbuda	162 Schedar
016 Algedi	065 Caph	114 Menkalinan	163 Seginus
017 Algenib	066 Castor	115 Menkar	164 Shaula
018 Algiebra	067 Celabrai	116 Menkent	165 Sheiak
019 Algol	068 Celaeno	117 Menkib	166 Sheratan
020 Algorab	069 Chara	118 Merak	167 Sirius
021 Alhena	070 Chertan	119 Merope	168 Skat
022 Alioth	071 Cor Caroli	120 Mesartim	169 Spica
023 Alkaid	072 Cursa	121 Miaplacidus	170 Sterope
024 Alkalurops	073 Dabih	122 Mintaka	171 Sulafat
025 Alkes	074 Deneb	123 Mira	172 Syrma
026 Almach	075 Deneb Algedi	124 Mirach	173 Talitha
027 Alnasl	076 Deneb Kaitos	125 Mirfak	174 Tania Australis
028 Alnilam	077 Denebola	126 Mirzam	175 Tania Borealis
029 Alnitak	078 Dubhe	127 Mizar	176 Tarazed
030 Alphard	079 Edasich	128 Muphrid	177 Taygeta
031 Alphecca	080 Electra	129 Muscida	178 Thuban
032 Alpheratz	081 Elnath	130 Nashira	179 Unukalhai
033 Alrakis	082 Eltanin	131 Nekkar	180 Vega
034 Alrescha	083 Enif	132 Nihal	181 Vindemiatrix
035 Alshain	084 Errai	133 Nunki	182 Wasat
036 Altair	085 Fomalhaut	134 Nusakan	183 Wazn
037 Altais	086 Furud	135 Peacock	184 Yed Posterior
038 Alterf	087 Gacrux	136 Phact	185 Yed Prior
039 Aludra	088 Giausar	137 Phecda	186 Zaniah
040 Alula Australis	089 Gienah	138 Pherkad	187 Zaurak
041 Alula Borealis	090 Gomeisa	139 Pleione	188 Zavijava
042 Alya	091 Graffias	140 Polaris	189 Zosma
043 Ancha	092 Groombridge 1830	141 Pollux	190 Zubenelgenubi
044 Ankaa	093 Grumium	142 Porrima	191 Zubeneschamali
045 Antares	094 Hamal	143 Procyon	192 Barnard's Star
046 Arcturus	095 Homan	144 Propus	193 Kapteyn's Star
047 Arkab	096 Izar	145 Rassalas	194 Kruger 60
048 Arneb	097 Kaus Australis	146 Rasagethi	195 Luyten's Star
049 Ascella	098 Kaus Borealis	147 Rasalhague	

Modern Constellations

No.	Constellation	Abbreviation	No.	Constellation	Abbreviation
1	Andromeda	And	45	Lacerta	Lac
2	Antlia	Ant	46	Leo	Leo
3	Apus	Aps	47	Leo Minor	LMi
4	Aquarius	Aqr	48	Lepus	Lep
5	Aquila	Aql	49	Libra	Lib
6	Ara	Ara	50	Lupus	Lup
7	Aries	Ari	51	Lynx	Lyn
8	Auriga	Aur	52	Lyra	Lyr
9	Boötes	Boo	53	Mensa	Men
10	Caelum	Cae	54	Microscopium	Mic
11	Camelopardalis	Cam	55	Monoceros	Mon
12	Cancer	Cnc	56	Musca	Mus
13	Canes Venatici	CVn	57	Norma	Nor
14	Canis Major	CMa	58	Octans	Oct
15	Canis Minor	CMi	59	Ophiuchus	Oph
16	Capricornus	Cap	60	Orion	Ori
17	Carina	Car	61	Pavo	Pav
18	Cassiopeia	Cas	62	Pegasus	Peg
19	Centaurus	Cen	63	Perseus	Per
20	Cepheus	Cep	64	Phoenix	Phe
21	Cetus	Cet	65	Pictor	Pic
22	Chamaeleon	Cha	66	Pisces	Psc
23	Circinus	Cir	67	Piscis Austrinus	PsA
24	Columba	Col	68	Puppis	Pup
25	Coma Berenices	Com	69	Pyxis	Pyx
26	Corona Australis	CrA	70	Reticulum	Ret
27	Corona Borealis	CrB	71	Sagitta	Sge
28	Corvus	Crv	72	Sagittarius	Sgr
29	Crater	Crt	73	Scorpius	Sco
30	Crux	Cru	74	Sculptor	Scl
31	Cygnus	Cyg	75	Scutum	Sct
32	Delphinus	Del	76	Serpens	Ser
33	Dorado	Dor	77	Sextans	Sex
34	Draco	Dra	78	Taurus	Tau
35	Equuleus	Equ	79	Telescopium	Tel
36	Eridanus	Eri	80	Triangulum	Tri
37	Fornax	For	81	Triangulum Australe	TrA
38	Gemini	Gem	82	Tucana	Tuc
39	Grus	Gru	83	Ursa Major	UMa
40	Hercules	Her	84	Ursa Minor	UMi
41	Horologium	Hor	85	Vela	Vel
42	Hydra	Hya	86	Virgo	Vir
43	Hydrus	Hyi	87	Volans	Vol
44	Indus	Ind	88	Vulpecula	Vul

Deep Sky Object List

ID No.	OBJECT	NGC #	Messier#	IC#	A(Abell)	U(UGC)	ID No.	OBJECT	NGC #	Messier#	IC#	A(Abell)	U(UGC)
1	Andromeda Galaxy	224	31				31	Hind's Variable Nebula	1555				
2	Barnards Galaxy	6822					32	Hubble's Variable Nebula	2261				
3	Beehive Cluster	2632	44				33	Integral Sign Galaxy					3697
4	Blackeye Galaxy	4926	64				34	Jewel Box Cluster	4755				
5	Blinking Planetary Nebula	6826					35	Keyhole Nebula	3372				
6	Blue Flash Nebula	6905					36	Lagoon Nebula	6523	8			
7	Blue Planetary	3918					37	Little Gem	6445				
8	Blue Snowball Nebula	7662					38	Little Gem Nebula	6818				
9	Box Nebula	6309					39	Little Ghost Nebula	6369				
10	Bubble Nebula	7635					40	North American Nebula	7000				
11	Bipolar Nebula	6302					41	Omega Nebula	6618	17			
12	Butterfly Cluster	6405	6				42	Orion Nebula	1976	42			
13	California Nebula	1499					43	Owl Nebula	3587	97			
14	Cat's Eye Nebula	6543					44	Pelican Nebula			5070		
15	Cocoon Nebula			5146			45	Phantom Streak Nebula	6741				
16	Cone Nebula	2264					46	Pinwheel Galaxy	598	33			
17	Cork Nebula	650-51	76				47	Pleiades		45			
18	Crab Nebula	1952	1				48	Ring Nebula	6720	57			
19	Crescent Nebula	6888					49	Ring Tail Galaxy	4038				
20	Draco Dwarf					10822	50	Rosette Nebula	2237				
21	Duck Nebula	2359					51	Saturn Nebula	7009				
22	Dumbbell Nebula	6853	27				52	Sextans B Dwarf					5373
23	Eagle Nebula		16				53	Small Magellanic Cloud	292				
24	Eight-Burst Nebula	3132					54	Sombrero Galaxy	4594	104			
25	Eskimo Nebula	2392					55	Spindle Galaxy	3115				
26	Flaming Star Nebula			405			56	Tank Track Nebula	2024				
27	Ghost of Jupiter	3242					57	Trifid Nebula	6514	20			
28	Great Cluster	6205	13				58	Ursa Minor Dwarf					9749
29	Helix Nebula	7293					59	Whirlpool Galaxy	5194	51			
30	Hercules Galaxy Cluster			2151			60	Wild Duck Cluster	6705	11			

Double Star List

No.	Object	Const	Sep.	Magitude	SAO	Comm. Name
1	Gam	And	9.8	2.3 / 5.1	37734	Almaak
2	Pi	And	35.9	4.4 / 8.6	54033	
3	Bet	Aql	12.8	3.7 / 11	125235	Alshain
4	11	Aql	17.5	5.2 / 8.7	104308	
5	15	Aql	34	5.5 / 7.2	142996	
6	E2489	Aql	8.2	5.6 / 8.6	104668	
7	57	Aql	36	5.8 / 6.5	143898	
8	Zet	Aqr	2.1	4.3 / 4.5	146108	
9	94	Aqr	12.7	5.3 / 7.3	165625	
10	41	Aqr	5.1	5.6 / 7.1	190986	
11	107	Aqr	6.6	5.7 / 6.7	165867	
12	12	Aqr	2.5	5.8 / 7.3	145065	
13	Tau	Aqr	23.7	5.8 / 9.0	165321	
14	Gam	Ari	7.8	4.8 / 4.8	92681	Mesartim
15	Lam	Ari	37.8	4.8 / 6.7	75051	
16	The	Aur	3.6	2.6 / 7.1	58636	
17	Nu	Aur	55	4.0 / 9.5	58502	
18	Ome	Aur	5.4	5.0 / 8.0	57548	
19	Eps	Boo	2.8	2.5 / 4.9	83500	Izar
20	Del	Boo	105	3.5 / 7.5	64589	
21	Mu 1	Boo	108	4.3 / 6.5	64686	Alkalurops
22	Tau	Boo	4.8	4.5 / 11	100706	
23	Kap	Boo	13.4	4.6 / 6.6	29046	
24	Xi	Boo	6.6	4.7 / 6.9	101250	
25	Pi	Boo	5.6	4.9 / 5.8	101139	
26	Iot	Boo	38	4.9/7.5/13	29071	
27	E1835	Boo	6.2	5.1 / 6.9	120426	
28	44	Boo	2.2	5.3 / 6.2	45357	
29		Cam	2.4	4.2 / 8.5	24054	
30	32	Cam	21.6	5.3 / 5.8	2102	
31	Alp 2	Cap	6.6	3.6 / 10	163427	Secunda giedi
32	Alp 1	Cap	45	4.2 / 9.2	163422	Prima giedi
33	Pi	Cap	3.4	5.2 / 8.8	163592	
34	Omi	Cap	21	5.9 / 6.7	163625	
35	Alp	Cas	64.4	2.2 / 8.9	21609	Shedir
36	Eta	Cas	12.9	3.5 / 7.5	21732	Achird
37	Iot	Cas	2.3	4.7/7.0/8.2	12298	
38	Psi	Cas	25	4.7 / 8.9	11751	
39	Sig	Cas	3.1	5.0 / 7.1	35947	
40	E3053	Cas	15.2	5.9 / 7.3	10937	
41	3	Cen	7.9	4.5 / 6.0	204916	
42	Bet	Cep	13.6	3.2 / 7.9	10057	Alfirk
43	Del	Cep	41	3.5 / 7.5	34508	
44	Xi	Cep	7.6	4.3 / 6.2	19827	Al kurhah
45	Kap	Cep	7.4	4.4 / 8.4	9665	
46	Omi	Cep	2.8	4.9 / 7.1	20554	
47	E2840	Cep	18.3	5.5 / 7.3	33819	
48	E2883	Cep	14.6	5.6 / 7.6	19922	
49	Gam	Cet	2.8	5.0 / 7.7	110707	Kaffaljidhma
50	37	Cet	50	5.2 / 8.7	129193	
51	66	Cet	16.5	5.7 / 7.5	129752	
52	Eps	CMa	7.5	1.5 / 7.4	172676	Adhara
53	Tau	CMa	8.2	4.4/10/11	173446	
54	145	CMa	25.8	4.8 / 6.8	173349	
55	Mu	CMa	2.8	5.0 / 7.0	152123	
56	Nu 1	CMa	17.5	5.8 / 8.5	151694	
57	Iot	Cnc	30.5	4.2 / 6.6	80416	
58	Alp	Cnc	11	4.3 / 12	98267	Acubens
59	Zet	Cnc	6	5.1 / 6.2	97646	
60	24	Com	20.6	5.0 / 6.6	100160	
61	35	Com	1.2	5.1/7.2/9.1	82550	
62	2	Com	3.7	5.9 / 7.4	82123	
63	Zet	CrB	6.1	5.0 / 6.0	64833	
64	Gam	Crt	5.2	4.1 / 9.6	156661	
65	Del	Crv	24.2	3.0 / 9.2	157323	Algorab
66	Alp	CVn	19.4	2.9 / 5.5	63257	Cor caroli
67	25	CVn	1.8	5.0 / 6.9	63648	
68	2	CVn	11.4	5.8 / 8.1	44097	
69	Gam	Cyg	41	2.2 / 9.5	49528	Sadr
70	Del	Cyg	2.5	2.9 / 6.3	48796	

No.	Object	Const	Sep.	Magitude	SAO	Comm. Name	No.	Object	Const	Sep.	Magitude	SAO	Comm. Name
71	Bet	Cyg	34.4	3.1 / 5.1	87301	Albireo	106	Del	Her	8.9	3.1 / 8.2	84951	Sarin
72	Omi 1	Cyg	107	3.8 / 6.7	49337		107	Mu	Her	34	3.4 / 9.8	85397	
73	52	Cyg	6.1	4.2 / 9.4	70467		108	Alp	Her	4.6	3.5 / 5.4	102680	Rasalgethi
74	Ups	Cyg	15.1	4.4 / 10	71173		109	Gam	Her	42	3.8 / 9.8	102107	
75	Mu	Cyg	1.9	4.7 / 6.1	89940		110	Rho	Her	4.1	4.6 / 5.6	66001	
76	Psi	Cyg	3.2	4.9 / 7.4	32114		111	95	Her	6.3	5.0 / 5.2	85647	
77	17	Cyg	26	5.0 / 9.2	68827		112	Kap	Her	27	5.0 / 6.2	101951	
78	61	Cyg	30.3	5.2 / 6.0	70919		113	E2063	Her	16.4	5.7 / 8.2	46147	
79	49	Cyg	2.7	5.7 / 7.8	70362		114	100	Her	14.3	5.9 / 5.9	85753	
80	E2762	Cyg	3.4	5.8 / 7.8	70968		115	54	Hya	8.6	5.1 / 7.1	182855	
81	E2741	Cyg	1.9	5.9 / 7.2	33034		116	HN69	Hya	10.1	5.9 / 6.8	181790	
82	Gam	Del	9.6	4.5 / 5.5	106476		117	Eps	Hyd	2.7	3.4 / 6.8	117112	
83	Eta	Dra	5.3	2.7 / 8.7	17074		118	The	Hyd	29.4	3.9 / 10	117527	
84	Eps	Dra	3.1	3.8 / 7.4	9540	Tyl	119	N	Hyd	9.4	5.6 / 5.8	179968	
85	47	Dra	34	4.8 / 7.8	31219		120		Lac	28.4	4.5 / 10	72155	
86	Nu	Dra	61.9	4.9 / 4.9	30450		121	8	Lac	22	5.7/6.5/10	72509	
87	Psi	Dra	30.3	4.9 / 6.1	8890		122	Gam 1	Leo	4.4	2.2 / 3.5	81298	Algieba
88	26	Dra	1.7	5.3 / 8.0	17546		123	Iot	Leo	1.7	4.0 / 6.7	99587	
89	16&17	Dra	90	5.4/5.5/6.4	30012		124	54	Leo	6.6	4.3 / 6.3	81583	
90	Mu	Dra	1.9	5.7 / 5.7	30239		125	Gam	Lep	96	3.7 / 6.3	170757	
91	40/41	Dra	19.3	5.7 / 6.1	8994		126	Iot	Lep	12.8	4.4 / 10	150223	
92	1	Equ	10.7	5.2 / 7.3	126428		127	Kap	Lep	2.6	4.5 / 7.4	150239	
93	The	Eri	4.5	3.4 / 4.5	216114	Acamar	128	h3752	Lep	3.2	5.4 / 6.6	170352	
94	Tau 4	Eri	5.7	3.7 / 10	168460		129	Iot	Lib	57.8	4.5 / 9.4	159090	
95	Omi 2	Eri	8.3	4.4/9.5/11	131063	Keid	130		Lib	23	5.7 / 8.0	183040	
96	32	Eri	6.8	4.8 / 6.1	130806		131	Mu	Lib	1.8	5.8 / 6.7	158821	
97	39	Eri	6.4	5.0 / 8.0	149478		132	Eta	Lup	15	3.6 / 7.8	207208	
98	Alp	For	5.1	4.0 / 6.6	168373	Fornacis	133	Xi	Lup	10.4	5.3 / 5.8	207144	
99	Ome	For	10.8	5.0 / 7.7	167882		134	38	Lyn	2.7	3.9 / 6.6	61391	
100	Alp	Gem	3.9	1.9 / 2.9	60198	Castor	135	12	Lyn	1.7	5.4/6.0/7.3	25939	
101	Del	Gem	5.8	3.5 / 8.2	79294	Wasat	136	19	Lyn	14.8	5.8 / 6.9	26312	
102	Lam	Gem	9.6	3.6 / 11	96746		137	Bet	Lyr	46	3.4 / 8.6	67451	Sheliak
103	Kap	Gem	7.1	3.6 / 8.1	79653		138	Zet	Lyr	44	4.3 / 5.9	67321	
104	Zet	Gem	87	3.8/10/8.0	79031	Mekbuda	139	Eta	Lyr	28.1	4.4 / 9.1	68010	Aldafar
105	38	Gem	7.1	4.7 / 7.7	96265		140	Eps 1	Lyr	2.6	5.0 / 6.1	67309	Double dbl1

No.	Object	Const	Sep.	Magitude	SAO	Comm. Name	No.	Object	Const	Sep.	Magitude	SAO	Comm. Name
141	Eps 2	Lyr	2.3	5.2 / 5.5	67315	Double dbl2	176	Zet	Psc	23	5.6 / 6.5	109739	
142	Alp	Mic	20.5	5.0 / 10	212472		177	Kap	Pup	9.9	4.5 / 4.7	174199	
143	Zet	Mon	32	4.3 / 10	135551		178	Eta	Pup	9.6	5.8 / 5.9	174019	
144	Eps	Mon	13.4	4.5 / 6.5	113810		179	Eps	Scl	4.7	5.4 / 8.6	167275	
145	Bet	Mon	7.3	4.7/4.8/6.1	133316		180	Bet	Sco	13.6	2.6 / 4.9	159682	Graffias
146	15	Mon	2.8	4.7 / 7.5	114258		181	Sig	Sco	20	2.9 / 8.5	184336	Alniyat
147	70	Oph	4.5	4.0 / 5.9	123107		182	Nu	Sco	41	4.2 / 6.1	159764	Jabbah
148	67	Oph	55	4.0 / 8.6	123013		183	2	Sco	2.5	4.7 / 7.4	183896	
149	Lam	Oph	1.5	4.2 / 5.2	121658	Marfic	184		Sco	23	5.4 / 6.9	207558	
150	Xi	Oph	3.7	4.4 / 9.0	185296		185	Hn39	Sco	5.4	5.9 / 6.9	184369	
151	36	Oph	4.9	5.1 / 5.1	185198		186	12	Sco	3.9	5.9 / 7.9	184217	
152	Tau	Oph	1.7	5.2 / 5.9	142050		187	Bet	Ser	31	3.7 / 9.0	101725	
153	Rho	Oph	3.1	5.3 / 6.0	184382		188	Del	Ser	4.4	4.2 / 5.2	101624	
154	39	Oph	10.3	5.4 / 6.9	185238		189	Nu	Ser	46	4.3 / 8.5	160479	
155	Bet	Ori	9.5	0.1 / 6.8	131907	Rigel	190	The	Ser	22.3	4.5 / 5.4	124070	Alya
156	Del	Ori	53	2.2 / 6.3	132220	Mintaka	191	59	Ser	3.8	5.3 / 7.6	123497	
157	Iot	Ori	11.3	2.8 / 6.9	132323	Nair al saif	192	Zet	Sge	8.5	5.0 / 8.8	105298	
158	Lam	Ori	4.4	3.6 / 5.5	112921	Meissa	193	Eta	Sgr	3.6	3.2 / 7.8	209957	
159	Sig	Ori	13	3.8/7.2/6.5	132406		194		Sgr	5.5	5.2 / 6.9	209553	
160	Rho	Ori	7.1	4.5 / 8.3	112528		195	Phi	Tau	52	5.0 / 8.4	76558	
161	E747	Ori	36	4.8 / 5.7	132298		196	Chi	Tau	19.4	5.7 / 7.6	76573	
162	1	Peg	36.3	4.1 / 8.2	107073		197	118	Tau	4.8	5.8 / 6.6	77201	
163	Eps	Per	8.8	2.9 / 8.1	56840		198	6	Tri	3.9	5.3 / 6.9	55347	
164	Zet	Per	12.9	2.9 / 9.5	56799	Atik	199	Zet	UMa	14	2.4 / 4.0	28737	Mizar
165	Eta	Per	28.3	3.3 / 8.5	23655	Miram in becvar	200	Nu	UMa	7.2	3.5 / 9.9	62486	Alula borealis
166	The	Per	18.3	4.1 / 10	38288		201	23	UMa	23	3.6 / 8.9	14908	
167	E331	Per	12.1	5.3 / 6.7	23765		202	Ups	UMa	11.6	3.8 / 11	27401	
168	Del	PsA	5.1	4.2 / 9.2	214189		203	Xi	UMa	1.8	4.3 / 4.8	62484	Alula australia
169	Iot	PsA	20	4.3 / 11	213258		204	Sig 2	UMa	3.9	4.8 / 8.2	14788	
170	Bet	PsA	30.3	4.4 / 7.9	213883		205	57	UMa	5.4	5.4 / 5.4	62572	
171	Gam	PsA	4.2	4.5 / 8.0	214153		206	Alp	UMi	18.4	2.0 / 9.0	308	Polaris
172	Eta	PsA	1.7	5.8 / 6.8	190822		207	Gam	Vir	1.4	3.5 / 3.5	138917	Porrima
173	Alp	Psc	1.8	4.2 / 5.2	110291	Alrisha	208	The	Vir	7.1	4.4 / 9.4	139189	
174	55	Psc	6.5	5.4 / 8.7	74182		209	Phi	Vir	4.8	4.8 / 9.3	139951	
175	Psi	Psc	30	5.6 / 5.8	74483		210	84	Vir	2.9	5.7 / 7.9	120082	

IOPTRON ONE YEAR TELESCOPE, MOUNT, AND CONTROLLER WARRANTY

A. iOptron warrants your telescope, mount, or controller to be free from defects in materials and workmanship for one year. iOptron will repair or replace such product or part which, upon inspection by iOptron, is found to be defective in materials or workmanship. As a condition to the obligation of iOptron to repair or replace such product, the product must be returned to iOptron together with proof-of-purchase satisfactory to iOptron.

B. The Proper Return Merchant Authorization Number must be obtained from iOptron in advance of return. Call iOptron at 1.781.569.0200 to receive the RMA number to be displayed on the outside of your shipping container.
All returns must be accompanied by a written statement stating the name, address, and daytime telephone number of the owner, together with a brief description of any claimed defects. Parts or product for which replacement is made shall become the property of iOptron.

The customer shall be responsible for all costs of transportation and insurance, both to and from the factory of iOptron, and shall be required to prepay such costs.

iOptron shall use reasonable efforts to repair or replace any telescope, mount, or controller covered by this warranty within thirty days of receipt. In the event repair or replacement shall require more than thirty days, iOptron shall notify the customer accordingly. iOptron reserves the right to replace any product which has been discontinued from its product line with a new product of comparable value and function.

This warranty shall be void and of no force of effect in the event a covered product has been modified in design or function, or

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If warranty problems arise, or if you need assistance in using your telescope, mount, or controller contact:

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Tel. (781)569-0200
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Monday-Friday 9AM-5PM EST

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