SmartStar® CubePro™ Telescope Mount

Instruction Manual

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WARNING!

NEVER USE A TELESCOPE TO LOOK AT THE SUN!
Looking at or near the Sun will cause instant and irreversible damage to your eye. Children should always have adult supervision while observing.

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1. SmarStar® CubePro™ Mount Overview

1.1. SmartStar® CubePro™ Mount

Our proprietary ***Grab 'N Go*** Alt-Azimuth Mount*, a.k.a*. The Cube, is one of the most functional and flexible units on the market. The CubePro™ mount has metal worms and ring gears. Both axis motors are built into a small single unit which is universally compatible with all telescopes using a Vixen-type dovetail connection. The Go2Nova® hand controller on each CubePro mount is easy to use with menus for planets, stars, nebulas, and constellations. And at only 3.1 lb you can take it anywhere and get accurate tracking! The controller is designed so you can easily set up your telescope and command it where to point to. It also has a large LCD screen displaying more text lines than the competition's (so you don't have to keep scrolling to read the screen). The revolutionary GOTONOVA® computerized control system is one of the most technologically advanced automated tracking systems available on the market today. There are no "dead spots" -- so you can point your telescope to anywhere above the horizon. This mount can be operated by 8 AA batteries or an external AC/DC power adapter, makes it an idea travel mount.

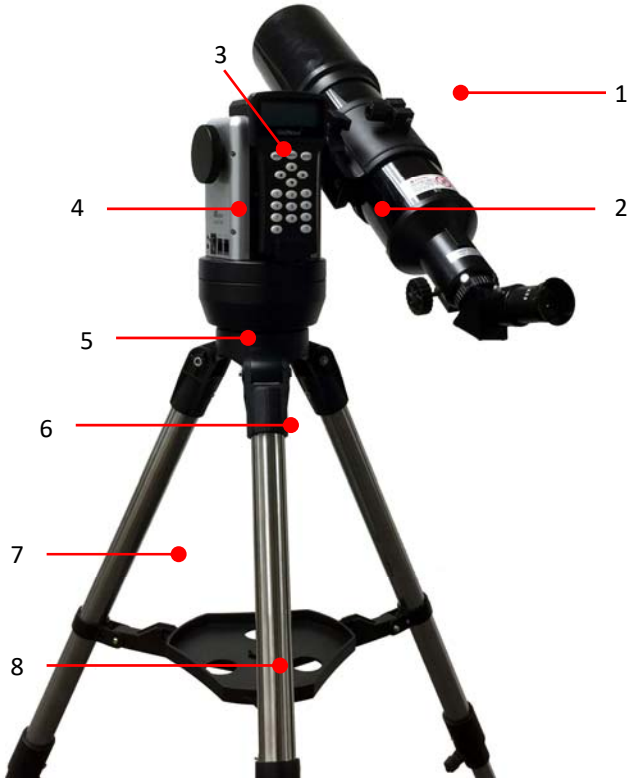
The new CubePro™ mount has a completely redesigned electronics and firmware while keeping the simplicity and sturdy of the original CubePro mount. The new features including:

- All new electronics
- Super quiet tracking
- 8408 Go2Nova® hand controller with AA/EQ dual operation
- Large database with 150,000+ objects
- Fully computer controllable using latest iOptron Commander and ASCOM
- New 1.25" stainless steel tripod
- Attaches to a camera tripod with 3/8" thread (or ¼ thread via a converter)
- Wireless control with ***optional*** StarFi™ Wi-Fi adapter

Features:

- ***Grab 'N Go*** altazimuth mount – The CubePro: the only mount of its kind for ultimate rotation
- Metal worms and ring gears
- 8 lbs payload for various scopes and cameras, with 3.1 lb mount head
- Go2Nova® 8408 hand controller with Advanced GOTONOVA® GOTO Technology
- 150,000+ object database with 60 user-defined objects
- Large LCD screen with 4 lines and 21-characters hand control with backlit LED buttons
- Dual-axis servomotor with optical encoder
- 9 speed for precise mount moving control
- Built-in 32-channel Global Positioning System (GPS)
- Altazimuth/equatorial (AA/EQ) dual operation (need a wedge for EQ operation)
- Vixen-type dovetail saddle
- 3lbs counterweight and stainless steel CW shaft included
- Operate on 8 AA batteries (not included)
- 3/8" threads to fit on camera mount
- 100~240V AC power adapter included, optional 12V DC adapter (#8418) available
- Serial port for firmware upgrade and computer control
- Latest ASCOM and iOptron Commander for mount remote control
- RS232-RJ9 serial cable for firmware upgrade and computer control
- Sturdy 1.25" stainless steel tripod
- *Optional* StarFi™ WiFi adapter #8434 for mount wireless control

1.2. Assembly Terms



CubePro Assembly Terms

1. Telescope Tube
2. Dovetail lock screw
3. Hand controller
4. Altitude lock
5. Mount
6. Azimuth lock screw
7. Tripod
8. Tray

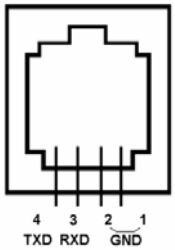
1.3. Go2Nova® 8408 Hand Controller

8408 Hand Controller

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

1.3.1. Key Description

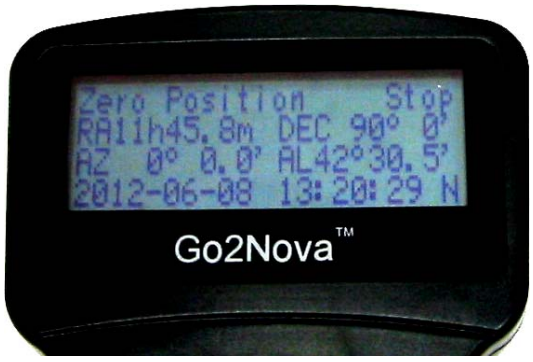
- MENU Key: Press “MENU” to enter the Main Menu.
- BACK Key: Move back to the previous screen, or end/cancel current operation, such as slewing.
- ENTER Key: Confirm an input, go to the next menu, select a choice, or slew the telescope to a selected object.
- Arrow (▲▼◄►) Keys: The arrow keys are used 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 a CubePro mount using a 6 pin 4 wire (6P4C) or 6 pin 6 wire (6P6C) RJ11 plug.
- Serial port: connect the HC to a computer via a RS232 to 4 pin 4 wire (4P4C) RJ9 cable for firmware upgrade and computer controller. The pin out of the serial port is shown as below.



Serial port pin out on an 8408 hand controller

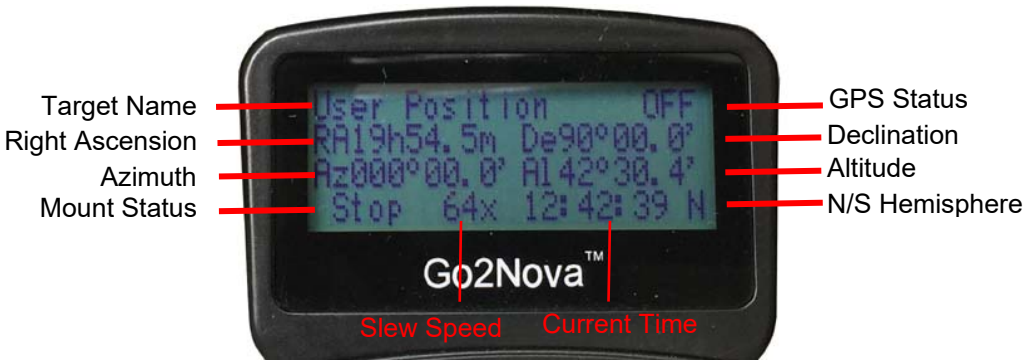
1.3.2. The LCD Screen

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 Zero Position/User Position screen may be displayed after company logo displayed. The Zero Position with current date and time is displayed as:



8408 Initial Information Screen

The LCD screen will switch to the operation screen after the operation of slew or goto, as indicated in the following photo:



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. GPS Status: “**ON**” indicates GPS module is installed; “**OK**” GPS connected to satellites; “**OFF**” GPS module not installed/disconnected/malfunctioned
3. Right Ascension: Right Ascension of the telescope, or R.A.
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”;
   - Track: mount is tracking
8. Slew speed: It has 9 speeds: 1X, 2X, 8X, 16X, 64X, 128X, 256X, 512X, MAX(~ 4°/sec).
9. Current Time: display local time in a format of HH:MM:SS.

1.4. Check the Battery

The hand controller has a real time clock (RTC) which should display the correct time every time the mount is turned on. If the time is incorrect, please check the battery inside the hand controller and replace it if needed. The battery is a 3V, CR1220 button battery.

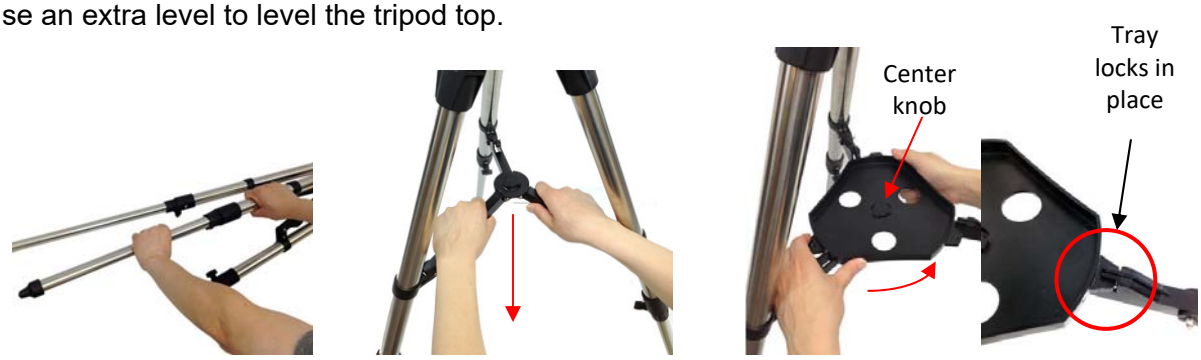
2. CubePro™ Mount Assembly

CubePro mount is operated as an alt-azimuth mount (AA Mode) in most cases. It can also be operated as an equatorial mount (EQ Mode) when an EQ wedge is used.

2.1. Setup a Mount in AA Mode

STEP 1. Tripod Setup

1. Extend tripod legs to full extension and lock knobs.
2. Stand Tripod upright. Then press down to lock center arms in place.
3. Place tray on center knob and turn tray until it locks in place. *(The tray will turn underneath the center knob)*
4. Use an extra level to level the tripod top.



STEP 2 Attach the CubePro Mount

Put the mount on top of the tripod head and secure it using the Azimuth Lock Screw.

STEP 3. Install Batteries

The mount can be operated by either 8 AA batteries or an AC/DC adapter (**STEP 5**). To install the batteries, lift the battery cover. Carefully pull out the battery holder from the compartment. Be sure not to accidentally disconnect the wires.

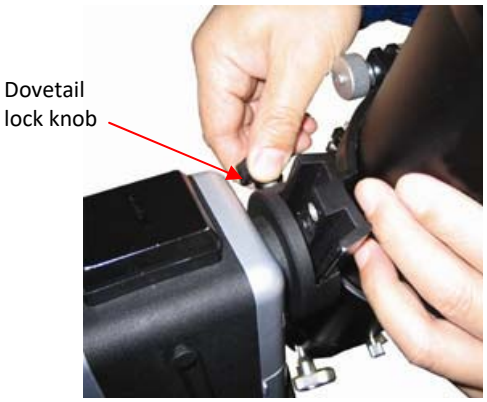
Insert 8 AA batteries *(not included)* into the battery holder, with the polarities match the diagram on the holder.. Replace the holder back into the battery compartment and replace the lid.

The battery holder only fits into the battery compartment in one direction. If it can't fit in, turn the holder 90 degree and make sure the wires are not block the holder. Do not mix new batteries with old ones.

STEP 4. Attach and Balance a Telescope

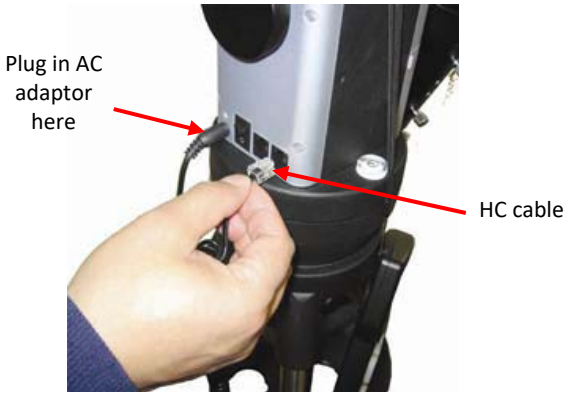
The mount has a Vixen-type dovetail saddle. It accepts any telescope (under payload limit) with a Vixen dovetail bar. Release the dovetail lock knob. Slide the telescope dovetail bar into the dovetail saddle. Retighten the dovetail lock knob.

Attach all the accessories to the telescope. Loosen altitude lock a little, with another hand hold the scope. Check the mount balance. If the telescope eyepiece end tends to move down, move the scope forward. If the telescope objective lens end (front side) tends to move down, move the scope backward. You may leave the telescope a little bit front heavy.



STEP 5. Connect Cables

Connect the Go2Nova 8408 hand controller into either one of the two HBX ports on the mount using coiled control cable. Plug 12V DC power supply into the power socket on the mount panel, if use external power source to power the mount. The red LED will be on when power switch is turned on.



STEP 6. Level the Mount

Leveling is critical for a good GOTO and tracking accuracy.

To level the mount:

1. Locate the air bubble inside the bull's eye circular level, as shown on the left. Adjust the tripod legs to move the bubble inside the small circle. It is always help if you level the tripod first when set it up.
2. Turn on the mount. Press "9" button to change the slew speed to MAX.
3. Rotate the mount 90° incremental by pressing ► or ◄ button to check if the bubble stays inside the circle. If it wonders out of the circle, adjust the legs to bring it back in.
4. Slew the mount 360° in azimuth to make sure the mount is leveled.
5. Fully tighten/lock the tripod legs.

If the bubble does not stay inside the small circle, you may need to calibrate the level by make sure it stays at the same position while rotating the mount. Mark the new bubble position as a calibrated center position.

STEP 7. Setup Zero Position

This STEP is for AA Mode Only. For EQ mode, please refer to Section *2.2. Setup a Mount in EQ Mode.*

The start point of a CubePro mount is the Zero Position. For an alt-azimuth (AA) operation mode, its altitude is 90º00'00" and azimuth is 180º00'00", which means the "SOUTH" mark is pointing to south and the telescope is pointing straight up at the zenith. To set the Zero Position (after leveling the mount):

1. Turn on the mount. Press "***9***" button to change the slew speed to MAX.
2. Slew the mount and rotate the SOUTH mark pointing to south using ► or ◄ button. Use a compass to assist the process. Please do not put the compass on top of the mount. The electronics inside the mount will affect the compass. Also be aware that the magnetic south pointed by the compass is not the true south that we are looking for. If you use a compass in your smart phone, you may set the compass to "Use True North", if it has this option.
3. Slew the mount and rotate the telescope to point straight up at the Zenith using ▲ or ▼ button. A torpedo level may help.
4. Press **MENU**=> "***Zero Position***" => "***Set Zero Position***" and **ENTER** to complete the Zero Position setting.

Any Zero Position discrepancy will be correct by star alignment or target synchronization operation later.

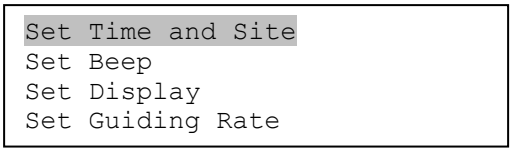
STEP 8. Setup Hand Controller

Correct time and location info is needed for precise GOTO. The CubePro is equipped with a GPS, the mount will receive the UTC time, longitude and latitude information from satellites after the link is established. However, there are still some parameters need to be entered to reflect your location, such as time zone info (UTC offset) and daylight saving time (DST). The information will be stored inside the hand controller memory along with longitude and latitude coordinates until they need to be changed. A clear sky outside is needed for GPS to communicate well with the satellites.

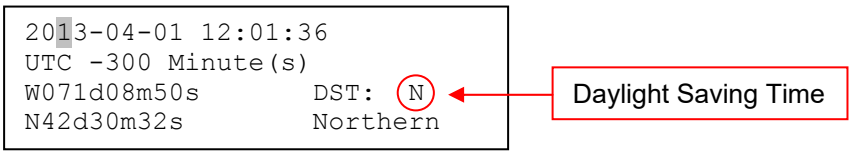
To set up the controller, turn the mount power ON. Press **MENU**=> "***Settings***":

```
Select and Slew
Sync. to Target
Alignment
Settings
```

Press ENTER and select "*Set Time and Site"*



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



Set Local Time

The time will be updated automatically when the GPS receiver has established its link with the GPS satellites. In the event that the GPS module is unable to establish a link to the satellites, local time can be entered manually. Use the ◄ or ► key to move the cursor _ and use the number keys to change the numbers. Use the ▲ or ▼ button to toggle between "Y" and "N" for Daylight Saving Time, or "+" and "-" for UTC (Coordinated Universal Time) setting. Hold the arrow key to fast forward or rewind the cursor.

In order to make the Hand Controller reflect your correct local time, **time zone information has to be entered.** Press the ◄ or ► key, move the cursor to the third line "**UTC -300 Minute(s)**" to set the time zone information (add or subtract 60 minutes per time zone). For example:

- Boston is "UTC -300 minutes"
- Los Angeles is "UTC -480 minutes"
- Rome is "UTC +60 minutes"
- Beijing is "UTC +480 minutes"
- Sydney is "UTC +600 minutes"

All the time zones in North America are "UTC –", as shown in the following table, so ensure the display shows "UTC -" instead of "UTC +" if in North or South America.

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

To adjust minutes, move the cursor to each digit and use the number keys to input the number directly. Use ▲ or ▼ key to toggle between "**+**" and "**-**". When the time information entered is correct, press ENTER and go back to the previous screen. **Note that fractional time zones can be entered.**

Do not manually add or subtract an hour from displayed time to reflect Daylight Saving Time (DST). Only select "**Y**" after DST begins.

For other parts of the world you can find your "time zone" information from internet.

Set Observation Site Coordinate

The third and fourth lines display the longitude and latitude coordinates, respectively. The longitude and latitude coordinates will be automatically updated when the GPS picks up satellite signals. "W/E" means western/eastern hemisphere; "N/S" means northern/southern hemisphere; "d" means degree; "m" means minute; and "s" means second.

If, for any reason, your GPS can't pick up a signal, you can manually enter the GPS coordinates. 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.

The site coordinates information can be found from your smart phone, GPS receiver or via the internet. Site information in decimal format can be converted into d:m:s format by multiplying the decimal numbers by 60. For example, N47.53 can be changed to N47º31'48": 47.53º = 47º +0.53º, 0.53º=0.53x60'=31.8', 0.8'=0.8x60"=48". Therefore, 47.53º=47º31'48" or 47d31m48s.

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

Set Daylight Saving Time

Keep moving the cursor by pressing ► key after setting the coordinate until it moves on DST section. Change the DST to "N" or "Y" accordingly.

Check Mount Operation Mode

The hand controller support both AA and EQ operation. Make sure the operation mode is same as your mount set up. If the mount is set at AA operation, as in most cases, make sure the hand controller setting is in AA mode. Press **MENU**=> "***Settings***":

```
Select and Slew
Sync. to Target
Alignment
Settings
```

Press **ENTER** and scroll the cursor down. If it displays "***Enter EQ Mode***" at the end of the menu, the mount is already at the A/A mode. Otherwise, select "***Enter AA Mode***"

```
Set Altitude Limit
GPS Status
Language
Enter EQ Mode
```

Check the Hand Controller Battery

The hand controller has a real time clock which should display the correct time every time the mount is turned on. If the time is off too much, please check the battery inside the hand controller and replace it if required. The battery is a 3V, CR1220 button battery.

2.2. Install Counterweight

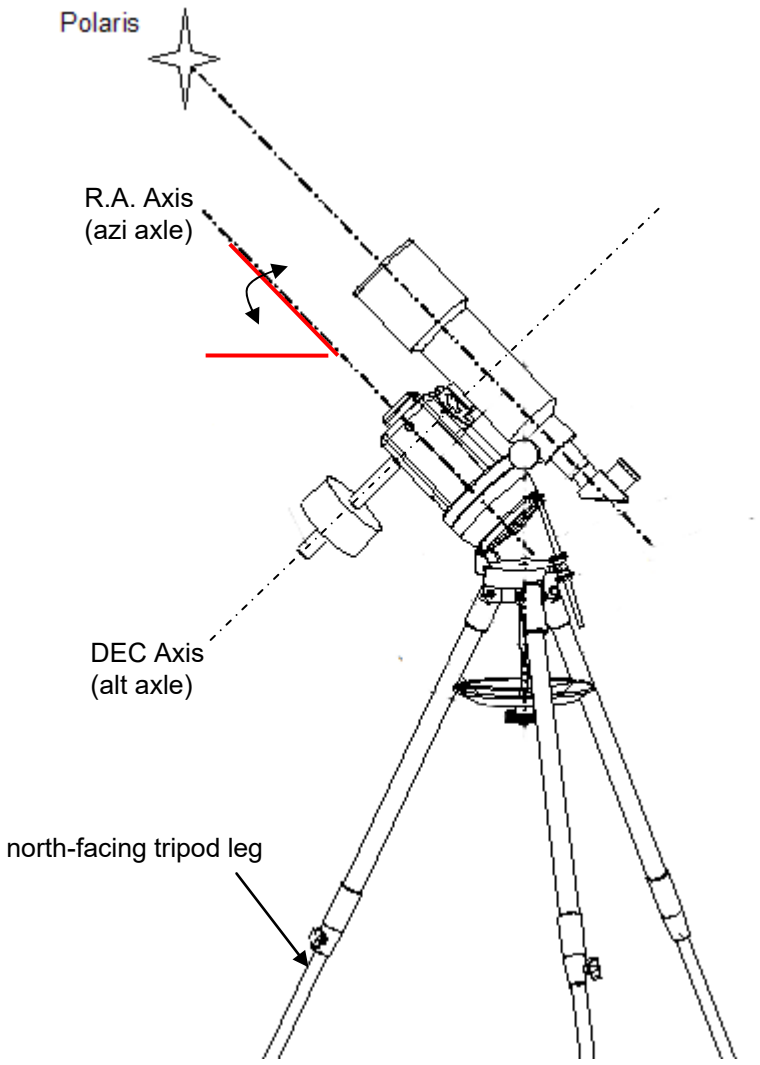
The CubePro mount comes with a 3 lbs counterweight (CW) and a stainless steel CW shaft. It is optional to use a CW in AA operation. It should improve the mount performance when installed, especially for a OTA with a relative large diameter and/or long tube length. It is required for EQ operation.

Unlock and remove the altitude lock (#4). Screw on the CW shaft and tighten it. Slide the CW onto the counterbalance shaft. Secure the CW by tightening the lock knob.

2.3. Setup a Mount in EQ Mode

With a proper wedge, such as iOptron dual AZ/EQ tripod (#8601), the CubePro mount can be operated at the EQ mode.

Please Note: the Zero Position of an EQ mode is different from that of an AA mode. It is the position with the CW shaft pointing toward the ground, OTA at the highest position with its axis parallel to the polar axis and the OTA pointing to the Celestial Pole (see photo below).



Follow the steps below to set the mount in EQ mode (with iOptron AZ/EQ dual tripod):

1. Align the north-facing tripod leg (the leg under the wedge hinge) to the north. A compass is needed. A true north will give you better tracking performance. Use this link to find out how to determine the true north (http://www.ngdc.noaa.gov/geomag-web/#declination).
2. Level the tripod.
3. Find the latitude of the observation site.
4. Raise the wedge by loosen the tilt locks, until its tilt angle equals to the observation site latitude.
5. Replace the ALT lock with counterweight shaft (optional) if an optional counterweight is needed.

6. Align the altitude axle (with or without CW) that is pointing straight down, in line with the north-facing tripod leg. This can be done by either loosen the azimuth lock or turn the mount using ◄ or ► key. The altitude axle will served as the DEC axis of the EQ mode.
7. Mount the OTA onto the mount and align its optical axis parallel to the azimuth axle of the mount. This can be done by either loosen the altitude lock or turn the mount using ▲ or ▼ key. The azimuth axle will served as the R.A. axis of the EQ mode.
8. Adjust the mount in altitude by tilt the wedge up/down and in azimuth by turn the tripod left/right to locate the Polaris (if you are in northern hemisphere) in your finder scope and/or your telescope eyepiece. Center it. Tighten the tilt locking screws.
9. Power the mount on. Press **MENU** => "***Settings***" => "***Enter EQ Mode***". Power OFF/ON the mount.
10. Press **MENU** => "***Zero Position***" => "***Set Zero Position***" to set the Zero Position.
11. Press **MENU** => "***Alignment***" to perform star alignment or polar alignment.

3. Get Started

3.1. Setup the Mount

If you are using the mount in AA mode (majority of the users), assemble the mount and set the Zero Position follow the instruction.

If you are using the mount in EQ mode, set the mount on a wedged tripod. Set the hand controller to EQ mode. Polar align the mount.

3.2. Get Familiar with Telescope

3.2.1. Use the telescope

Image Orientation

The image orientation changes depending on how the eyepiece is inserted into the telescope. When using the star diagonal (the 90º mirror diagonal), the image is right-side-up, but reversed from left-to-right (i.e., mirror image). If inserting the eyepiece directly into the visual back (i.e., without the star diagonal), the image is upside-down and reversed from left-to-right (i.e., inverted). This is normal for the refractor design.

Actual image orientation as seen with the unaided eye

Reversed from left to right, as viewed with a Star Diagonal

Inverted image, as viewed with the eyepiece directly in telescope

Corrected image, as viewed with a Erect Lens or Erect Diagonal

For terrestrial observation, such as land mark or bird viewing, you can buy an optional 45º Erect Diagonal to have a correct image from your eyepiece.

Select an Eyepiece

The magnification of a telescope is defined by the focal lengths of the telescope and the eyepiece. A formula can be used to determine the power of each eyepiece: Telescope focal length divided by eyepiece focal length equals magnification.

For example, for a R90 telescope with a focal length of 500mm, if a 25mm eyepiece is used, the magnification will be

500mm ÷ 25mm = 20X (magnification)

If more magnification is wanted, you may order higher power eyepieces. (Note: a 25 mm focal length eyepiece has a lower power than a 10 mm one.)

Always start with the lowest power eyepiece for easy locating the objects.

Focus a Telescope

1. After selecting the desired eyepiece, aim the telescope tube at a land-based target at least 200 yards away (e.g. A telephone pole or building). Fully extend focusing tube by turning the focus knob.
2. While looking through selected eyepiece, slowly retract focusing tube by turning focusing knob until object comes into focus.

Aligning Finderscope

1. Look through main telescope tube and establish a well-defined target (see focusing telescope section). Tighten all lock knobs (Right Ascension, Declination, Altitude, Azimuth, etc) so that telescope's aim is not disturbed.
2. Turn on the red dot finder and look through the finder window. Adjust the red dot alignment screws to center the red dot on the object.
3. Now, objects centered in the finderscope will be shown in the field of view of the main telescope.

3.3. Move the telescope

Manually Move the Telescope

Slightly loose Altitude Lock (part #5 on the mount, as indicated in Assembly Terms) and Azimuth Lock (as shown in Assembly Step 2); push the mount to rotate left or right and push the telescope to point up or down.

When you finished observation, please re-tighten both locks to avoid accidentally drop of the mount or telescope.

Move the Telescope using a Hand Controller

Insert 8 fresh AA batteries into the mount battery holder, or using an optional AC adapter, Tighten all the screws and locks on tripod, mount and telescope. Flip the ON/OFF switch on the mount to turn the mount power on. After a beep and LCD displays information screen, press the number 9 button to change the slew speed to MAX.

Press ▲▼► or ◄ button to move the telescope UP, DOWN, RIGHT or LEFT. Aim and focus the telescope to a distant object. Press the arrow button while viewing through the eyepiece. Press a number button to change the speed, if the object is moving too fast.

3.4. Initial Star Alignment

Perform a simple one 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**=>"***Alignmen***t"=>"***One Star Align***"=>**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 4.3)

An alternate way is to perform "***Sync to Target***." Press **MENU**=>"***Sync. To Target***", follow the on-screen instruction to center the star and press **ENTER**. You may need to use the number keys to change the slewing speed to make the centering procedure easier.

3.5. Go to the Moon and Other Stars

After performing these setups, the mount is ready to GOTO and track objects. One of the most common objects is the Moon.

To slew to the Moon press **MENU**=>"***Select and Slew***"=>"***Solar System***"=>***Moon***=>**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. You may use "***Sync to Target***" to improve the tracking.

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

3.6. Star Identification Function

The 8408 hand controller has a star identification function. After slew the telescope to an bright star, manually or using GOTO, press **?** button to identify the star name telescope is pointing to, as well as nearby bright stars if there is any.

3.7. GOTO and Tracking Position Memorization

The CubePro mount can memorize its positions if the mount loses power by accident, even during high speed slewing. Just do a ***Select and Slew*** to the same star the power is back. The mount will continue to track.

3.8. Turn Off the Mount

After finishing observation, just simply turn the mount power off and disassemble the mount and tripod.

If the mount is set up on a pier or inside an observatory, you can return the mount to **Zero Position**. This will ensure that there is no need for you to perform the initial setup again when you power up the mount subsequently, if the mount is not moved. To return the mount to its Zero Position, press the **MENU** => "***Zero Position***" => "***Goto Zero Position***" and press **ENTER**. Once the telescope returns to Zero Position turn the power off.

4. Complete Functions of Go2Nova® 8408 Hand Controller

4.1. Slew to an Object

Press **MENU** => "***Select and Slew***." Select an object that you would like to observe and press the **ENTER** key.

The Go2Nova® 8408 hand controller for CubePro mount has a database of over 150,000 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. The mount will only goto those object above the horizon. In some catalogs those stars below the horizon will not display on the hand controller.

4.1.1. Solar System

There are 9 objects in the Solar system catalog.

4.1.2. 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 Catalog: consists of 7,840 objects in NGC catalog.
- IC Catalog: consists of 5,386 objects in IC catalog.
- UGC Catalog: consists of 12,921 objects.
- Caldwell Catalog: consists of 109 objects.
- Abell Catalog: consists of 4076 objects.
- Herschel Catalog: consists of 400 objects.

4.1.3. Stars:

- Named Stars: consists of 259 stars with their common names. They are listed alphabetically. A list is included in Appendix E.
- Double/Multi Stars: consists of 208 double/multi stars. A list is attached in Appendix E.
- Hipparcos Catalog: the new HIP catalog consists of 120,404 records (2008).

4.1.4. Comets

This catalog contains 15 comets.

4.1.5. Asteroids

This catalog contains 116 asteroids.

4.1.6. Constellations

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

4.1.7. Custom Objects

It can store up to 60 used entered objects, including comets.

4.1.8. Custom R.A. and DEC

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

4.2. Sync to Target

This operation will match the telescope's current coordinates to Target Right Ascension and Declination. Press **MENU** => "***Sync to Target***" => **ENTER**. Select an object to want to sync to. Follow the instruction on the screen to perform the sync. 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.

Using this function will re-calibrate the computer to the selected object. This operation is most useful to find a faint star or nebula near a bright star. "***Sync to Target***" will improve the local goto accuracy around the synced star.

4.3. Alignment

This function is used to create a sky model to calibrate the mount's GOTONOVA® functionality. "***Solar System Align***", "***One Star Align***", "***Two Star Align***" and "***Three Star Align***" are designed for AA mode

It also provides methods to align the telescope to the celestial pole for the EQ mode. The "***Two Star Polar Align***" in EQ mode can used to refine the physical polar axis alignment. "***Polar Iterate Align***" uses a set of 2 bright stars for polar alignment providing a viable polar alignment approach for those who can't see the pole.

4.3.1. Pole Star Position (Only for EQ Mode)

This function displays the position of the Pole. In the Northern Hemisphere the position of Polaris is displayed, while in the Southern Hemisphere the position of Sigma Octantis is shown. This function is only useful for the EQ mode and the mount has an iOptron polar scope.

4.3.2. One Star Alignment

Press **MENU** => "***Alignment***" => "***One Star Alignment***". A list of alignment stars that are above the horizon is computed based on your local time and location. With the mount in the Zero Position, use the▲ and ▼ buttons to select a star and press **ENTER**. Center the target in your eyepiece using the arrow keys. Press **ENTER** when finished. If your mount is set up correctly and polar aligned, one star alignment should be sufficient for good GoTo accuracy. To increase the pointing accuracy over the sky, you may choose to do a two star alignment (for AA) or three star alignment (for EQ).

4.3.3. Two Star Alignment

Two Star Alignment can further improve the mount pointing accuracy. Press **MENU** => "***Alignment***" => "***Two Star Alignment***" 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 the ▲ and ▼ buttons to select the first alignment star and press **ENTER**. Center the target in your eyepiece using the arrow keys after the mount slews to it. Press **ENTER** when finished. The hand controller will prompt you to choose a second star. After centering the second star, the two-star alignment is finished.

After the two-star alignment, the altitude and azimuth misalignment error will be displayed. In EQ mode, this number can be used to fine tune the mount R.A. axis misalignment. Therefore this will further improve the accuracy of the mount's polar alignment.

For example, if the screen shows 7.5" low and 4.3" east, it means that THE MOUNT R.A. axis is pointing 7.5" lower and 4.3" to the east of the Celestial Pole.

4.3.4. Three Star Align

The three-star alignment will further determine the cone error between the OTA and mount axis in EQ mode. The system will use these data to calculate the goto model. If the cone error is too big, it is suggested to shim the OTA in DEC to minimize it.

Press **MENU** => "***Alignment***" => "***Three Star Alignment***" 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 the▲ and ▼ buttons to select the first alignment star and press **ENTER**. Center the target in your eyepiece using the arrow keys.

Press **ENTER** when finished. The hand controller will prompt you to choose a second star. Select third star after the mount aligned to the second star.

The system will display the pointing and cone errors after the three star alignment accepted. The system will update the pointing model accordingly.

4.3.5. Polar Iterate Align (Only for EQ Mode)

This alignment method allows you to polar align the mount even if you cannot view the Celestial Pole. Press the **MENU** => "***Alignment***" => "***Polar Iterate Align***". The HC will display a list of bright alignment stars near the meridian as Alignment Star A. Follow the HC instructions to move Alignment Star A to the center of the eyepiece using a combination of the Latitude Adjustment Knob and the "◄" and "►" buttons. Press **ENTER** to confirm the settings. Next, select a bright star that is close to the horizon as Alignment Star B. Center it using the Azimuth Adjustment Knobs and the "◄" and "►" buttons (*the "◢" and "◤" buttons will not function*). Press **ENTER** to confirm the settings.

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

NOTE: It is highly recommended to use an eyepiece with illuminated crosshairs for accurate centering.

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

4.3.6. Solar System Align

This function uses a planet or the moon as an alignment object. Press **MENU** => "***Alignment***" => "***Solar System Align***" for a list of available alignment objects.

4.3.7. Display Model Error

This will display linear RA error, linear DEC error, polar misalignment, non-perpendicular between OTA and DEC, and non-perpendicular between HA and DEC.

4.3.8. Clear Alignment Data

This will clear all alignment data created during one star, two star or three star alignment process.

It is recommended to clear the alignment data if a planetarium software with integrated alignment function is used to control the mount.

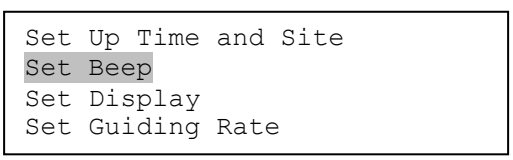
4.4. Set tings

4.4.1. Set Time and Site

Refer to STEP 8 in Section 2.1.

4.4.2. Set Beep

The Hand Controller allows a user to turn off the beep partially, or even go to a silent mode. To change this setting press **MENU** => "***Settings*"** => "***Set Beep***",



Select one of three available modes:

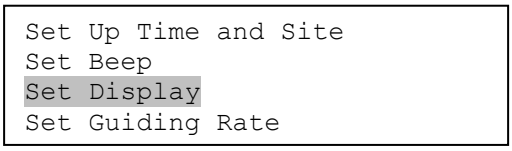
"**Always On**" – a beep will be heard on each button operation or mount movement;

"**On but Keyboard**" – a beep will be heard only when the mount is slewing to the object or there is a warning message;

"**Always Off**" – all sounds will be turned off, including the SUN warning message.

4.4.3. Set Display

Press MENU => "*Settings*" => "*Set Display*,"



Use the arrow keys to adjust LCD display contrast (***LCD contrast***), LCD backlight intensity (***LCD light***), and keypad's backlight intensity (***Key light***).

4.4.4. Set Tracking Rate

You can set up the mount tracking rate by selecting "***Set Tracking Rate***". Then the user can select "***Sidereal Rate***", "***Lunar Rate***", "***Solar Rate***", "***King Rate***", and "***User Defined Speed***". The "User defined speed" can be adjusted from 0.9900X to 1.0100X of sidereal.

The "King Rate", developed by Edward S. King, corrects the tracking rate of a telescope to account for atmospheric refraction. This is more useful for unguided tracking.

4.4.5. Set Altitude Limit

This function allows the mount to keep tracking an object even if it is below the horizon but can still be seen, for example from an elevated observation site, such as a hill. The default setting is 0 degree, which means the mount will stop tracking when the object is below horizon.

iOptron is not responsible for any equipment damage due to the mount keep tracking below horizon.

4.4.6. GPS Status

Display the GPS connection status. ***GPS ON*** indicates that the mount is still acquiring the satellite data. ***GPS OK*** indicates the link has been established. ***GPS OFF*** indicates either there is no GPS installed or the GPS is malfunctioning. Do not leave the hand controller at this submenu.

4.4.7. Language

Select one of supported menu languages.

4.4.8. Enter EQ/AA Mode

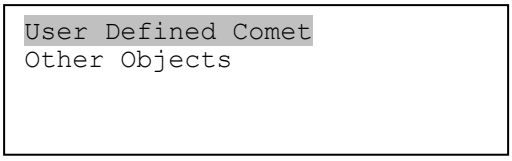
Switch the mount between AA and EQ mode.

4.5. Edit User Objects

Besides various star lists available in the hand controller, you can add, edit or delete your own user-defined objects. This is especially useful for newly found comets. You can also add your favorite observation object into the user object list for easy sky surfing. Up to 60 comets and other user objects can be stored.

4.5.1. Enter a New Comet

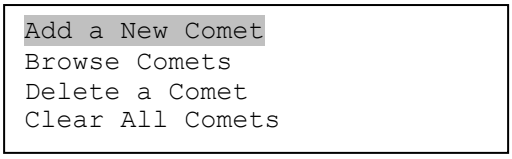
Press **MENU** => "***Edit User Objects***" to set user objects.



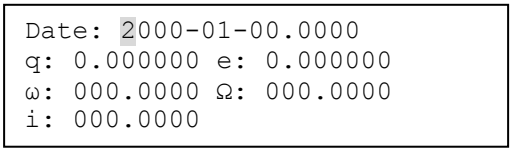
Select "***User Defined Comet***" to add/browse/delete the user-defined comet list. Find the orbit parameters of a comet in the SkyMap format. For example, the C/2012 ISON has an orbit parameter:

No.	Name	Year	M	Day	q	e	ω	Ω	I	H	G
C/2012	S1 ISON	2013	11	28.7960	0.0125050	1.0000030	345.5088	295.7379	61.8570	6.0	4.0

Select "***Add a New Comet***" to add a new one:



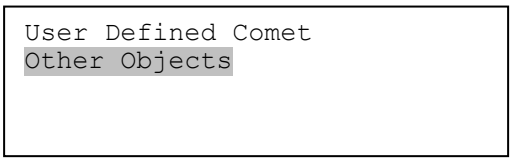
The hand controller will display the parameter entry screen:



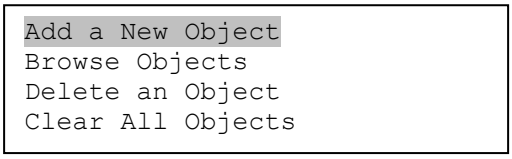
Enter the parameters using the arrow buttons and number keys. Press **ENTER** and a confirmation screen will be displayed. Press **ENTER** again to store the object under the assigned user object number, or press **BACK** button to cancel.

4.5.2. Enter Other Objects or Observation List

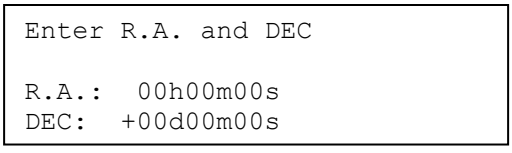
Press **MENU** => "***Edit User Objects*"** to set user objects.



Select "***Other Objects***" to enter you own object:



Select "***Add a New Object***". A screen will be displayed asking you to Enter R.A. and DEC coordinates:



You may enter the R.A. and DEC coordinates of the object you want to store, and press **ENTER** to confirm.

A more useful application of this function is to store your favorite viewing objects before heading to the field. When the "***Enter R.A. and DEC***" screen appears, press the **MENU** button. It brings up the catalogs that you can select the object from. Follow the screen instructions to add your favorite objects. Press **BACK** button to go back one level.

Press the **BACK** button to go back to the object entry submenu**.** You may review the records or delete those that are no longer wanted. Press the **BACK** button to finish the operation. Now you can slew to your favorite stars from "***Custom Objects***" catalog using "***Select and Slew***."

4.6. Firmware Information

This option will display the mount type, firmware version information for the hand controller (HC), R.A. board (RA), and DEC board (DEC).

4.7. Zero Position

4.7.1. Goto Zero Position

This moves your telescope to its Zero Position. When the power is turned on, the mount assumes the Zero Position. This is the reference point for alignment and GoTo functions.

4.7.2. Set Zero Position

This set the current mount position as the Zero Position.

5. Maintenance and Servicing

5.1. Maintenance

The SmartStar® CubePro™ mount to be maintenance free. Do not overload the mount. Do not drop the mount which will damage the mount or affect the GOTO tracking accuracy permanently. Use a wet cloth to clean the mount and hand controller. Do not use solvent.

When not in use, store the mount in a cool, dry place. Do not expose the instrument to excessive heat or moisture. It is best to store the mount in its original box with the altitude lock knob unlocked. If shipping the mount, use the original box and packing material to protect the mount during shipment.

If your mount is not to be used for an extended period, dismount the OTAs and counterweight. ***Remove the batteries from the battery holder if they were installed.***

5.2. Troubleshooting

The following suggestions may be helpful with operation of the SmartStar® CubePro mount.

The power indicator light on the mount does not come on or there is no response when pressing hand controller's arrow keys:

(1) Verify that the power switch on the mount is in the ON position.
(2) Verify that the hand controller cord is firmly connected to the HBX port on the mount, or switch the cord to the other HBX port.
(3) Press #9 button to change the slew speed to MAX and try it again.
(4) Check the power source, which include:
- Using the battery? Are the batteries installed correctly? Are the batteries fresh? How long have they been used? (frequent slew and GOTO will deplete battery power very quickly)
- Using AC or DC adapter? Check the plugs to the mount and to the power outlet.
- Using extension cord? Make sure the cord is in good condition. Power drop along the extension cord was known to cause the problem. Also check all the plugs and connections.

(5) If the mount does not respond to commands, set the power switch to OFF and then back to ON.
(6) If the mount does not slew after power is applied or if the motor quits or stalls, verify that there are no physical obstructions that would impede telescope movement.

Error Message "Warning! DEC. (or R.A.) driver motor over current. Please check balance."

(1) Check if the mount or OTA is blocked by any obstructions.
(2) Try to operate the mount without an OTA.
(3) Check the power supply. This is a common reason for this message and ***unexpected slew behavior or movement***. which include:
- Batteries: Are the batteries fresh? How long have they been used? (frequent slewing and GOTO will deplete battery power very quickly)
- AC or DC adapter: Check the plugs to the mount and to the power outlet.
- Extension cord: Make sure the cord is in good condition. Power drop along the extension cord has been known to cause this error message. Also check all the plugs and connections.

(4) Check the hand controller cord. Unplug it and re-plug into the other HBX port.

Error Message "Warning! Can not communicate with RA/DEC motor controller."

(1) Check the hand controller cord. Unplug it and re-plug into another HBX port.
(2) Check the power supply, which include:
- Using the battery? Is the battery fresh? How long it has been used? (frequent slew and GOTO will deplete battery power very quickly)
- Using AC or DC adapter? Check the plugs to the mount and to the power outlet.
- Using extension cord? Make sure the cord is in good condition. Power drop along the extension cord was known to cause the problem. Also check all the plugs and connections.

The object is jumping up and down in the eyepiece or over-slewed, and other unexpected slew behavior or movement.

(1) Use most updated firmware.
(2) Check the power supply, which include:
- Using the battery? Is the battery fresh? How long it has been used? (frequent slew and GOTO will deplete battery power very quickly)
- Using AC or DC adapter? Check the plugs to the mount and to the power outlet.
- Using extension cord? Make sure the cord is in good condition. Power drop along the extension cord was known to cause the problem. Also check all the plugs and connections.

(3) System balancing.

The telescope does not GOTO the right object, or the alignment is always wrong:

(1) Check the Zero Position by MENU=>"Zero Position"=>"Goto Zero Position". The mount should go back to zero position.
(2) Leveling (very important).
(3) Check site information (UTC offset and DST).
(4) System balancing.
(5) Use most updated firmware.
(6) Select right mount type (A/A or EQ).
(7) Check the power supply, which include:
- Using the battery? Is the battery fresh? How long it has been used? (frequent slew and GOTO will deplete battery power very quickly)
- Using AC or DC adapter? Check the plugs to the mount and to the power outlet.
- Using extension cord? Make sure the cord is in good condition. Power drop along the extension cord was known to cause the problem. Also check all the plugs and connections.

5.3. iOptron Customer Service

If you have a question concerning your telescope, contact the iOptron Customer Service Department. Customer Service hours are 9:00 AM to 5:00 PM, Easter Time, Monday through Friday. It is strongly suggested to send technical questions to support@ioptron.com for prompt response during off hour. Call in the U.S. 1.781.569.0200.

In the unlikely event that the telescope requires factory servicing or repairs, write or call the iOptron Customer Service Department first to receive a 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.

5.4. 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.

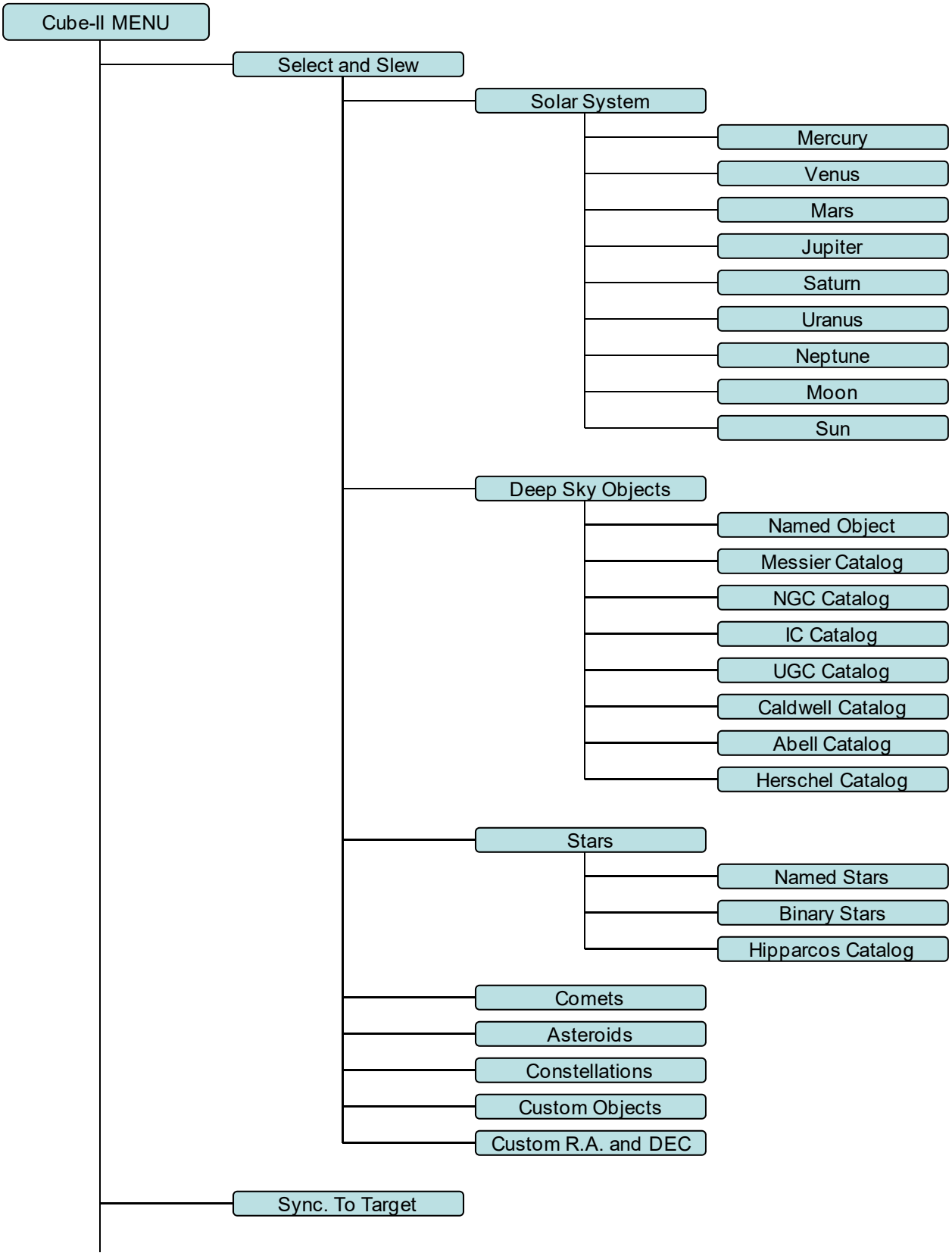
5.5. Battery Replacement and Disposal Instructions

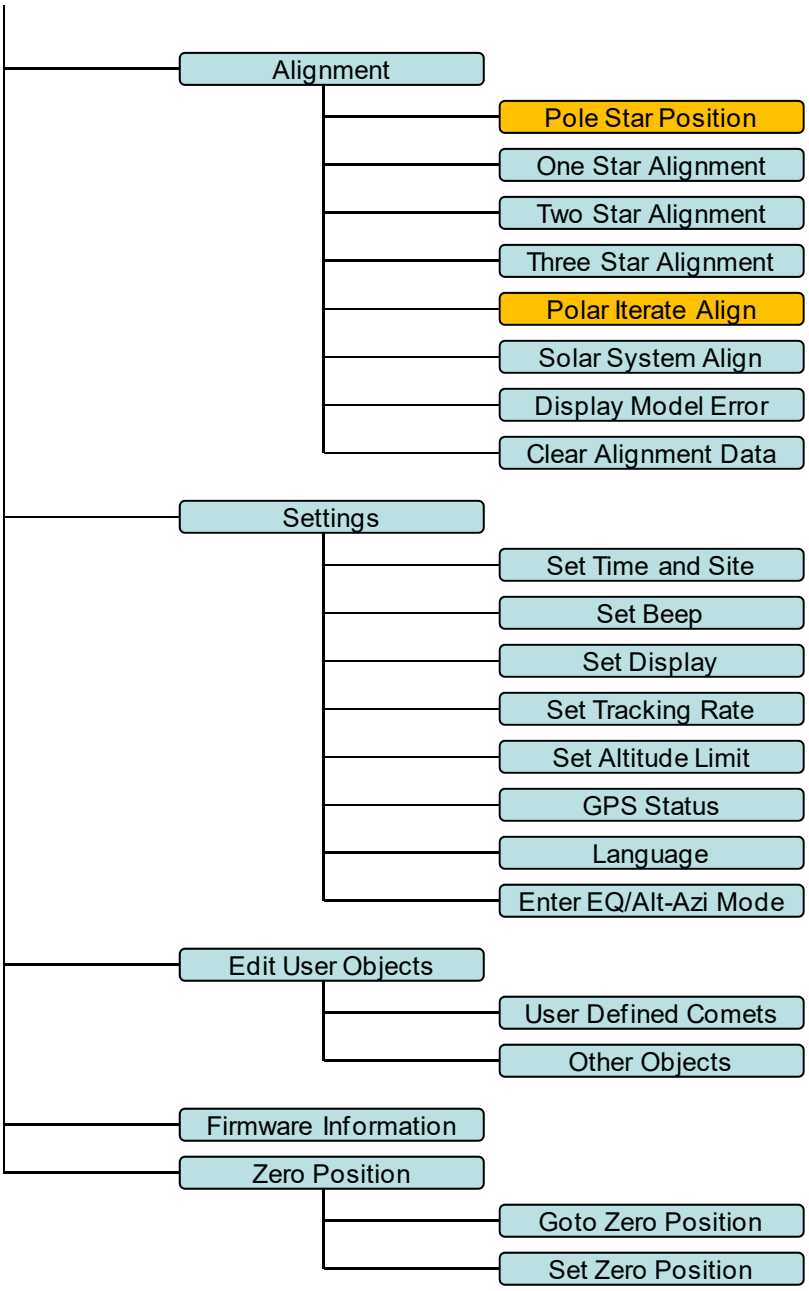
Battery Disposal- Batteries contain chemicals that, if released, may affect the environment and human health. Batteries should be collected separately for recycling, and recycled at a local hazardous material disposal location adhering to your country and local government regulations. To find out where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

Appendix A. Technical Specifications

Model Number	8200
Mount	AltAzimuth Mount
Body Materials	Die-cast Aluminum
Payload	8 lb
Mount Weight	3.1 lb (w/o batteries)
Motor	DC Servo motor with encoders
Gear	Aluminum ring gear/brass worm
Bearing	4 steel ball bearings
Hand Controller	Go2Nova® 8408 w AA/EQ dual mode
Database	150,000+ object database
Speed	1x,2×,8×,16x,64×,128x, 256x,512x, MAX
Resolution	0.5 arc minute
Tracking	Sidereal, Solar, Lunar, King and User Defined
Dovetail Saddle	Vixen
GPS	Yes
Battery	AA x 8（Not Included）
Power Requirement	12V DC(10~14V), >1.5Amp
AC Adapter	100V ~ 240V (included)
Base Connect	3/8” threaded socket
Tripod	1.25” Stainless Steel (~ 6 lb. or 3kg)
Serial Port	Yes (on hand controller)
Firmware Upgrade	Yes
PC Computer Control	Yes (iOptron Commander and ASCOM)
Wireless Control	Yes (with optional StarFi™ adapter #8434)
Operating Temp.	0 ~ 40°C
Warranty	Twoyear limited

Appendix B. Go2Nova® 8408 HC MENU STRUCTURE





Two Star Alignment : For both AA and EQ mode

Pole Star Position : For EQ mode only

Appendix C. Firmware Upgrade

The firmware in the 8408 hand controller and main control boards can be upgraded by the customer. Please check iOptron's website, www.iOptron.com, under the product page or Support Directory, select "CubePro w/ 8408HC" for detail.

Appendix D. Computer Control a CubePro Mount

The CubePro mount can be controlled by a SmartPhone, a Tablet or a computer. It is supported by two types of computer connections:

1. Connect to a computer via RS232 serial port. A serial cable (8412), and an optional RS232 to USB adapter (iOptron part# 8435), will be needed. Follow the adapter instructions to install the adapter driver. The mount can be controlled via ASCOM protocol (Windows OS), or directly by some software, such as Sky Safari (Mac OS)
2. Connect wirelessly with iOptron StarFi™ adapter (#8434) or some other third party adapter (may with limited function). The mount can be controlled via ASCOM protocol (Windows OS), SmartPhone/Tablet and Mac OS wirelessly. See StarFi Instruction Manual for detailed information.

To control the mount via ASCOM protocol, you need:

1. Download and install the latest ASCOM Platform, currently 6.2, from http://www.ascom-standards.org/. Make sure your PC meets the software requirement. For 6.2 SP1, Windows XP users should install .NET Framework 4. (not the Client Profile). Windows Vista and Windows 7 users should install .NET Framework 4.5.2. Windows 8 and beyond users do not need install any additional components.
2. Download and install the latest iOptron Telescope ASCOM drive for CubePro/8408 mount from iOptron website.
3. Planetarium software that supports ASCOM protocol. Follow software instructions to select the iOptron Telescope.

Please refer to iOptron website, www.iOptron.com, under the product page, or Support Directory, iOptron ASCOM Driver for more detail.

Appendix E. Go2Nova® Star List

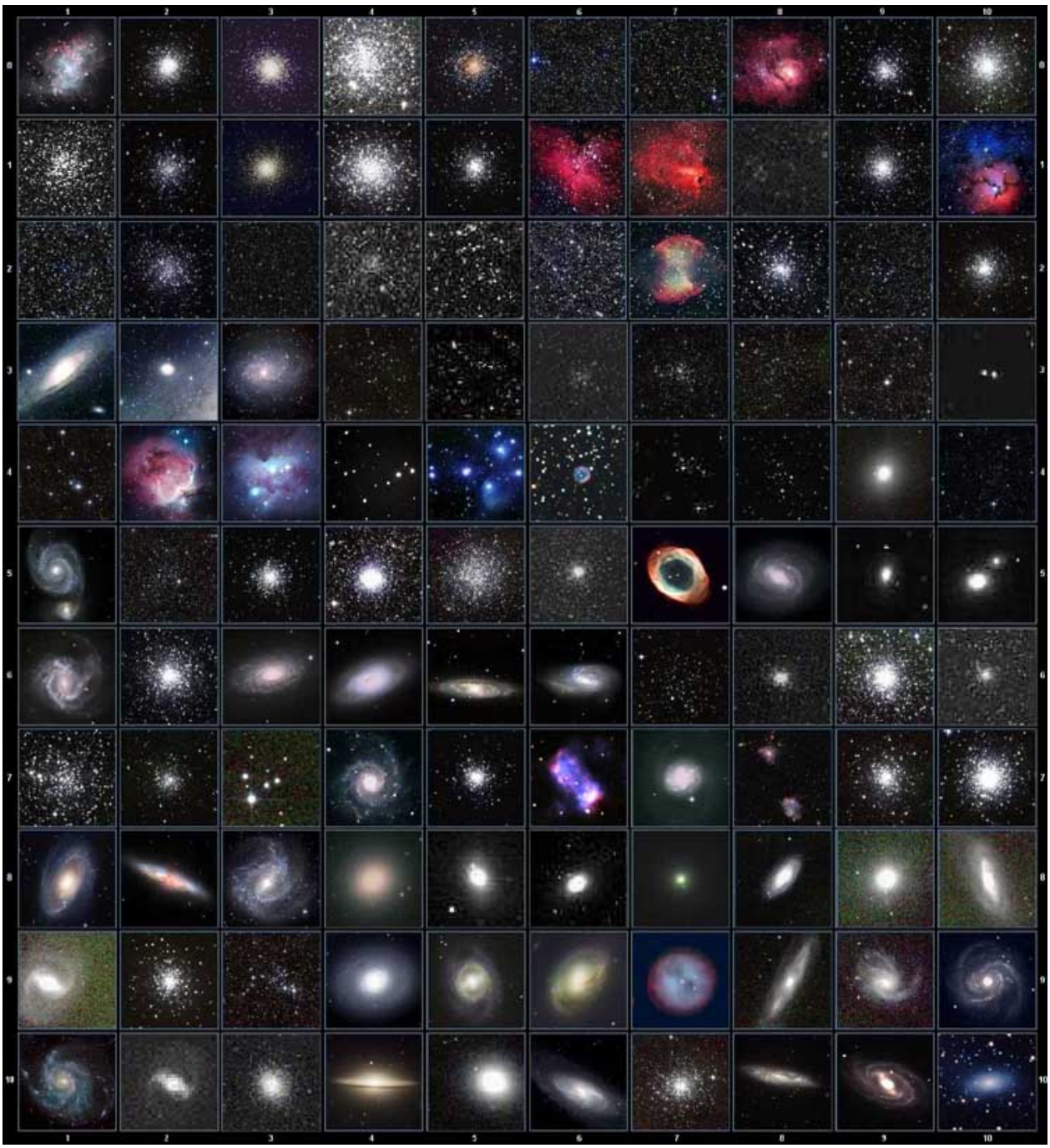
Go2Nova Deep Sky Object List

for 8408

ID No.	OBJECT	NGC #	Messier #	IC#	A(Abell)	U(UGC)
1	Andromeda Galaxy	224	31			
2	Barnards Galaxy	6822				
3	Beehive Cluster	2632	44			
4	Blackeye Galaxy	4926	64			
5	Blinking Planetary Nebula	6826				
6	Blue Flash Nebula	6905				
7	Blue Planetary	3918				
8	Blue Snowball Nebula	7662				
9	Box Nebula	6309				
10	Bubble Nebula	7635				
11	Bipolar Nebula	6302				
12	Butterfly Cluster	6405	6			
13	California Nebula	1499				
14	Cat's Eye Nebula	6543				
15	Cocoon Nebula			5146		
16	Cone Nebula	2264				
17	Cork Nebula	650-51	76			
18	Crab Nebula	1952	1			
19	Crescent Nebula	6888				
20	Draco Dwarf					10822
21	Duck Nebula	2359				
22	Dumbbell Nebula	6853	27			
23	Eagle Nebula		16			
24	Eight-Burst Nebula	3132				
25	Eskimo Nebula	2392				
26	Flaming Star Nebula			405		
27	Ghost of Jupiter	3242				
28	Great Cluster	6205	13			
29	Helix Nebula	7293				
30	Hercules Galaxy Cluster				2151	
31	Hind's Variable Nebula	1555				
32	Hubble's Variable Nebula	2261				
33	Integral Sign Galaxy					3697
34	Jewel Box Cluster	4755				
35	Keyhole Nebula	3372				
36	Lagoon Nebula	6523	8			
37	Little Gem	6445				
38	Little Gem Nebula	6818				

39	Little Ghost Nebula	6369				
40	North American Nebula	7000				
41	Omega Nebula	6618	17			
42	Orion Nebula	1976	42			
43	Owl Nebula	3587	97			
44	Pelican Nebula			5070		
45	Phantom Streak Nebula	6741				
46	Pinwheel Galaxy	598	33			
47	Pleiades		45			
48	Ring Nebula	6720	57			
49	Ring Tail Galaxy	4038				
50	Rosette Nebula	2237				
51	Saturn Nebula	7009				
52	Sextans B Dwarf					5373
53	Small Magellanic Cloud	292				
54	Sombrero Galaxy	4594	104			
55	Spindle Galaxy	3115				
56	Tank Track Nebula	2024				
57	Trifid Nebula	6514	20			
58	Ursa Minor Dwarf					9749
59	Whirlpool Galaxy	5194	51			
60	Wild Duck Cluster	6705	11			

Messier



Modern Constellations

No.	Constellation	Abbreviation
1	Andromeda	And
2	Antlia	Ant
3	Apus	Aps
4	Aquarius	Aqr
5	Aquila	Aql
6	Ara	Ara
7	Aries	Ari
8	Auriga	Aur
9	Boötes	Boo
10	Caelum	Cae
11	Camelopardalis	Cam
12	Cancer	Cnc
13	Canes Venatici	CVn
14	Canis Major	CMa
15	Canis Minor	CMi
16	Capricornus	Cap
17	Carina	Car
18	Cassiopeia	Cas
19	Centaurus	Cen
20	Cepheus	Cep
21	Cetus	Cet
22	Chamaeleon	Cha
23	Circinus	Cir
24	Columba	Col
25	Coma Berenices	Com
26	Corona Australis	CrA
27	Corona Borealis	CrB
28	Corvus	Crv
29	Crater	Crt
30	Crux	Cru
31	Cygnus	Cyg
32	Delphinus	Del
33	Dorado	Dor
34	Draco	Dra
35	Equuleus	Equ
36	Eridanus	Eri
37	Fornax	For
38	Gemini	Gem
39	Grus	Gru
40	Hercules	Her
41	Horologium	Hor
42	Hydra	Hya
43	Hydrus	Hyi
44	Indus	Ind

No.	Constellation	Abbreviation
45	Lacerta	Lac
46	Leo	Leo
47	Leo Minor	LMi
48	Lepus	Lep
49	Libra	Lib
50	Lupus	Lup
51	Lynx	Lyn
52	Lyra	Lyr
53	Mensa	Men
54	Microscopium	Mic
55	Monoceros	Mon
56	Musca	Mus
57	Norma	Nor
58	Octans	Oct
59	Ophiuchus	Oph
60	Orion	Ori
61	Pavo	Pav
62	Pegasus	Peg
63	Perseus	Per
64	Phoenix	Phe
65	Pictor	Pic
66	Pisces	Psc
67	Piscis Austrinus	PsA
68	Puppis	Pup
69	Pyxis	Pyx
70	Reticulum	Ret
71	Sagitta	Sge
72	Sagittarius	Sgr
73	Scorpius	Sco
74	Sculptor	Scl
75	Scutum	Sct
76	Serpens	Ser
77	Sextans	Sex
78	Taurus	Tau
79	Telescopium	Tel
80	Triangulum	Tri
81	Triangulum Australe	TrA
82	Tucana	Tuc
83	Ursa Major	UMa
84	Ursa Minor	UMi
85	Vela	Vel
86	Virgo	Vir
87	Volans	Vol
88	Vulpecula	Vul

Go2Nova Named Star List

(8408 V2 HC)

1	Acamar	50	Alrescha	99	Deneb el Okab	148	Lalande 21185
2	Achernar	51	Alshain	100	Deneb Kaitos	149	Lesath
3	Achird	52	Altair	101	Denebakrab	150	Mahasim
4	Acrab	53	Altais	102	Denebola	151	Maia
5	Acrux A	54	Alterf	103	Dschubba	152	Marfik
6	Acrux B	55	Aludra	104	Dubhe	153	Marfikent
7	Acubens	56	Alula Australis	105	Edasich	154	Markab
8	Adhafera	57	Alula Borealis	106	El Rehla	155	Markeb
9	Adhara	58	Alya	107	Electra	156	Matar
10	Adid Australis	59	Ancha	108	Elnath	157	Mebsuta
11	Ahadi	60	Ankaa	109	Eltanin	158	Megrez
12	Al Dhanab	61	Antares	110	Enif	159	Meissa
13	Al Dhibain Prior	62	Apollyon	111	Errai	160	Mekbuda
14	Al Kab	63	Arcturus	112	Fomalhaut	161	Menkalinan
15	Al Nair	64	Arkab Prior	113	Furud	162	Menkar
16	Al Nair al Baten	65	Arneb	114	Gacrux	163	Menkent
17	Al Niyat(Sigma)	66	Ascella	115	Gatria	164	Menkib
18	Al Niyat(Tau)	67	Asellus Austral	116	Giausar	165	Merak
19	Albaldah	68	Asellus Borealis	117	Gienah Corvi	166	Merope
20	Albali	69	Aspidiske	118	Gienah Cygni	167	Mesartim
21	Albireo	70	Atik	119	Girtab	168	Miaplacidus
22	Alchiba	71	Atlas	120	Gliese 1	169	Mimosa
23	Alcor	72	Atria	121	Gomeisa	170	Mintaka
24	Alcyone	73	Avior	122	Graffias(Zeta)	171	Mira
25	Aldebaran	74	Azha	123	Groombridge 1830	172	Mirach
26	Alderamin	75	Barnard's Star	124	Gruid	173	Mirfak
27	Alfirk	76	Baten Kaitos	125	Grumium	174	Mirzam
28	Algenib	77	Beid	126	Hadar	175	Mizar
29	Algenubi	78	Bellatrix	127	Hamal	176	Mu Velorum
30	Algieba	79	Beta Hydri	128	Han	177	Muhlifain
31	Algiedi Secunda	80	Betelgeuse	129	Hatsya	178	Muphrid
32	Algol	81	Betria	130	Head of Hydrus	179	Muscida
33	Algorab	82	Biham	131	Homam	180	Naos
34	Alhakim	83	Birdun	132	Iritjinga(Cen)	181	Nashira
35	Alhena	84	Canopus	133	Izar	182	Navi
36	Alioth	85	Capella	134	Kakkab Su-gub Gud-Elim	183	Nekkar
37	Alkaid	86	Caph	135	Kapteyn's Star	184	Nihal
38	Alkalurops	87	Castor A	136	Kaus Australis	185	Nunki
39	Alkes	88	Castor B	137	Kaus Borealis	186	Nusakan
40	Almaaz	89	Cebalrai	138	Kaus Media	187	Palida
41	Almach	90	Chara	139	Keid	188	Peacock
42	Alnasl	91	Chertan	140	Kekouan	189	Phact
43	Alnilam	92	Choo	141	Kitalpha	190	Phecda
44	Alnitak	93	Cor Caroli	142	Kochab	191	Pherkad
45	Alpha Muscae	94	Cursa	143	Koo She	192	Polaris
46	Alpha Tucanae	95	Dabih	144	Kornephoros	193	Pollux
47	Alphard	96	Deltotum	145	Kraz	194	Porrima
48	Alphecca	97	Deneb	146	Kurhah	195	Procyon
49	Alpheratz	98	Deneb Algedi	147	Lacaille 9352	196	Propus

197	Proxima Centauri	213	Sadalbari	229	Sulafat	245	Vindemiatrix
198	Rasalas	214	Sadalmelik	230	Syrma	246	Vrischika
199	Rasalgethi	215	Sadalsuud	231	Talitha	247	Wasat
200	Rasalhague	216	Sadr	232	Tania Australis	248	Wazn
201	Rastaban	217	Saiph	233	Tania Borealis	249	Wei
202	Regor	218	Sargas	234	Tarazed	250	Wezen
203	Regulus	219	Scheat	235	Taygeta	251	Yed Posterior
204	Rigel	220	Schedar	236	Tejat Posterior	252	Yed Prior
205	Rigel Kentaurus A	221	Seginus	237	Thuban	253	Zaniah
206	Rigel Kentaurus B	222	Shaula	238	Thusia	254	Zaurak
207	Ruchbah	223	Sheliak	239	Tien Kwan	255	Zavijava
208	Rukbat	224	Sheratan	240	Turais	256	Zeta Persei
209	Rukh	225	Sirius	241	Unukalhai	257	Zosma
210	Rutilicus	226	Skat	242	Vasat-ul-cemre	258	Zubenelgenubi
211	Sabik	227	Spica	243	Vathorz Posterior	259	Zubeneschamali
212	Sadachbia	228	Suhail	244	Vega		

Double/Multi Stars

1	RigelKentaurus A	53	HIP 95947	105	HIP 40167	157	HIP 28790
2	Rigel	54	HIP 30867	106	HIP 40817	158	HIP 4675
3	Gacrux	55	HIP 35363	107	HIP 81292	159	HIP 31676
4	Sargas	56	HIP 94761	108	HIP 80197	160	HIP 10176
5	Castor A	57	HIP 21683	109	HIP 88136	161	HIP 25950
6	Mizar	58	HIP 8497	110	HIP 42637	162	HIP 117931
7	Almach	59	HIP 26199	111	HIP 21039	163	HIP 81702
8	Algieba	60	HIP 104521	112	HIP 101027	164	HIP 21242
9	Aludra	61	HIP 116389	113	HIP 25768	165	HIP 86831
10	Iritjinga(Cen)	62	HIP 17797	114	HIP 94336	166	HIP 115272
11	Zubenelgenubi	63	HIP 21036	115	HIP 79980	167	HIP 46657
12	Alcyone	64	HIP 107310	116	HIP 12086	168	HIP 41404
13	Cor Caroli	65	HIP 72659	117	HIP 91919	169	HIP 29388
14	Acamar	66	HIP 21029	118	HIP 22531	170	HIP 49321
15	Adhafera	67	HIP 42726	119	HIP 34065	171	HIP 84054
16	Rasalgethi	68	HIP 18255	120	HIP 79607	172	HIP 39035
17	Meissa	69	HIP 9153	121	HIP 109786	173	HIP 25303
18	Graffias(Zeta)	70	HIP 88601	122	HIP 56280	174	HIP 52520
19	Alya	71	HIP 85829	123	HIP 51561	175	HIP 95771
20	HIP 48002	72	HIP 43937	124	HIP 107930	176	UCAC4 277-135548
21	HIP 96895	73	HIP 71762	125	HIP 98819	177	HIP 32609
22	HIP 20894	74	HIP 80047	126	HIP 117218	178	HIP 102531
23	HIP 74395	75	HIP 58484	127	HIP 81914	179	HIP 24825
24	HIP 27072	76	HIP 25142	128	HIP 111546	180	HIP 31158
25	HIP 26549	77	HIP 54204	129	HIP 29151	181	HIP 3885
26	HIP 85667	78	HIP 76669	130	HIP 107253	182	HIP 93717
27	HIP 74376	79	HIP 100965	131	HIP 88267	183	HIP 36345
28	HIP 34481	80	HIP 101123	132	HIP 81696	184	HIP 108364
29	HIP 53253	81	HIP 74911	133	HIP 97816	185	HIP 50939
30	HIP 99770	82	HIP 35210	134	HIP 30444	186	HIP 76603
31	HIP 63003	83	HIP 26235	135	HIP 66400	187	HIP 32269
32	HIP 43103	84	HIP 40321	136	HIP 17579	188	HIP 42516
33	HIP 110991	85	HIP 70327	137	HIP 35785	189	HIP 62807
34	HIP 20635	86	HIP 26221	138	HIP 81641	190	UCAC4 226-128246
35	HIP 88601	87	HIP 80473	139	HIP 7751	191	HIP 95398
36	HIP 2484	88	HIP 78105	140	HIP 21148	192	HIP 94761
37	HIP 92946	89	HIP 79043	141	HIP 9021	193	HIP 107299
38	HIP 79374	90	HIP 61418	142	HIP 97966	194	HIP 59984
39	HIP 102532	91	HIP 91971	143	HIP 90968	195	HIP 16411
40	HIP 52154	92	HIP 41639	144	HIP 36817	196	HIP 23287
41	HIP 37229	93	HIP 104214	145	HIP 25695	197	HIP 105637
42	HIP 30419	94	HIP 23734	146	HIP 99675	198	HIP 108925
43	HIP 108917	95	HIP 60189	147	HIP 61910	199	HIP 103814
44	HIP 53417	96	HIP 66821	148	HIP 111643	200	HIP 58112
45	HIP 65271	97	HIP 14043	149	HIP 80399	201	HIP 109354
46	HIP 67669	98	HIP 5737	150	HIP 83478	202	HIP 43822
47	HIP 105319	99	HIP 84626	151	HIP 101765	203	UCAC4 407-006677
48	HIP 80582	100	HIP 60904	152	HIP 28271	204	HIP 17470
49	HIP 8832	101	HIP 58684	153	HIP 64246	205	HIP 35960
50	HIP 69483	102	HIP 5131	154	HIP 97423	206	HIP 42936
51	HIP 93371	103	HIP 115126	155	HIP 35564	207	HIP 19272
52	HIP 86614	104	HIP 62572	156	HIP 37843	208	HIP 76143

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