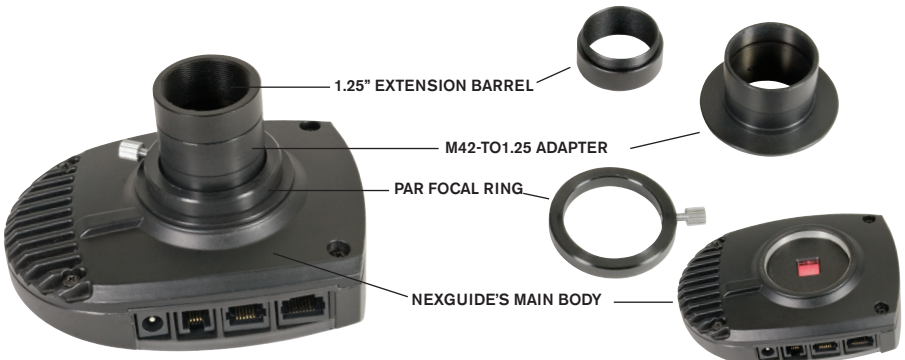
CELESTRON

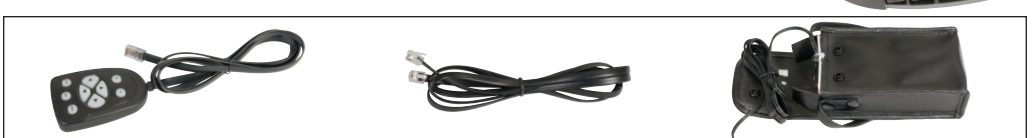
NexGuide USER'S MANUAL V2.0

THANK YOU FOR PURCHASING THE NEXGUIDE AUTOGUIDER! NEXGUIDE WILL IMPROVE THE QUALITY OF YOUR ASTROIMAGES AND HELP YOU ACHIEVE PINPOINT STARS DURING LONG EXPOSURES. NEXGUIDE ATTACHES DIRECTLY TO YOUR GUIDE SCOPE AND DOES NOT REQUIRE A COMPUTER.

ABOUT THE NexGuide PACKAGE

Please take some time to familiarize yourself with NexGuide before using it for the first time under the night sky. Some parts are pre-installed on NexGuide, so you may need to remove them before use. See instructions below for more details.





HAND CONTROL

GUIDING CABLE

BATTERY CASE

NexGuide MAIN BODY

FRONT VIEW

REAR VIEW

A. M42 Thread	**B. CCD Sensor**	**C. Power Jack**	**D. USB Port**
E. Autoguider Port	**F. Hand Control Port**	**G. LCD Screen**	

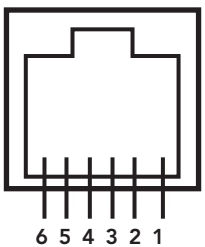
Powering NexGuide

NexGuide includes a battery case that accepts four D-Cell 1.5V batteries (not included). Alternatively, you may use an optional power supply that meets the following requirements:

- DC 6V~14V output voltage (lower voltage recommended)
- Output current of 250mA or more
- 2.1 mm power plug with positive tip

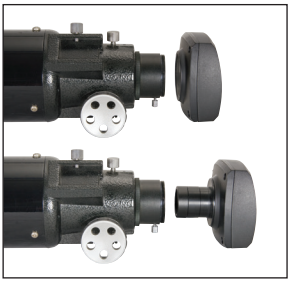
Technical Requirements

- **Telescope Mount:** Equatorial mount or Alt-Az mount with a wedge. The mount must have a dual-axis motor drive with "ST-4" compatible autoguiding port.
- **Guiding Cable:** You may use the supplied autoguiding cable if the pin configuration of your motor drive is the same as the diagram shown on the right.
- **Guide Scope:** An additional telescope with an M42-0.75 thread or a 1.25" eyepiece holder is required as a guide scope. An aperture of at least 80 mm helps reduce the exposure time of the NexGuide, yielding a more accurate guiding result. The ideal focal length is between 400 mm and 1200 mm. An adjustable guide scope tube ring, along with a finderscope or red dot finder will help you locate a guide star.



1 = NC
2 = Ground
3 = +RA (left)
4 = +DEC (up)
5 = –DEC (down)
6 = –RA (right)

Attaching NexGuide to a Guide Scope



There are two ways to install NexGuide:

- **Option 1:** Use an M42 thread adapter to thread NexGuide directly onto the guide scope. This installation method provides the most secure connection and is best suited for guide scopes equipped with a finderscope or a red dot finder.
- **Option 2:** Attach the M42-to-1.25 adapter to NexGuide, then insert and lock it into the 1.25-inch eyepiece holder on the guide scope. This method is suitable for those using a par-focal eyepiece to search for a guide star. When the star has been located, simply exchange the eyepiece for NexGuide.

Connecting Cables

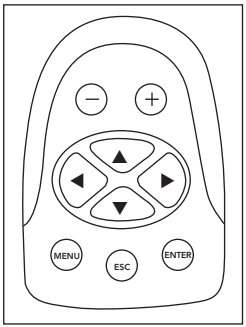
1. Plug the hand control into the connector labeled “Hand Control” on NexGuide.
2. Plug one end of the guiding cable into the port labeled “Auto Guider” and the other end into the guiding port on your mount.
3. Plug the battery pack or power supply into NexGuide’s power outlet.

Reading the LCD Display

The LCD screen is divided into two zones. The left half displays text information, such as the menu, data, and status of the device. The right half of the screen displays the image captured by the optical sensor.

Using the Hand Control

There are nine illuminated buttons on the Hand Control:



- **MENU**–Open and close the main menu
- **ESC**–Cancel an operation or quit from a menu
- **ENTER**–Confirm an operation or open a submenu
- **+/-**–Increase or decrease the exposure time
- **UP/DOWN**–The function of these buttons depends on the working mode of the autoguider.
  - **Preview Mode:** Move the dec motors at guiding rate
  - **Guiding Mode:** Set the Dec correction aggressiveness
  - **Menu Mode:** Scroll between menu items and change values under submenus
    - **Noise Menu:** Increase/decrease noise menu values
    - **Lock Menu:** Move crosshair vertically across preview area when manually locking on a star
  - **LEFT/RIGHT:** The function of these buttons depends on the working mode of the autoguider.
    - **Preview Mode:** Move the RA motors at guiding rate
    - **Guiding Mode:** Set the RA correction aggressiveness
    - **Menu Mode:** Scroll between menu items and change values under submenus
    - **Lock Menu:** Move crosshair horizontally across preview area when manually locking on a star

Navigating the Menus

Press the **MENU** button to activate the main menu tree. Use the **UP/DOWN** buttons to scroll between the menu items. Press the **ENTER** or **RIGHT** to choose between the following submenus:

- **ZM STAR or ZM CTR Menu**–These two menus zoom in on the image, and are only usable when NexGuide is in preview mode. Using the UP/DOWN buttons, choose between the zoom level 1 (the entire image), 2 (384x384 pixels of the image sensor), 3 (128x128 pixels of the image sensor) and 4 (64x64 pixels of the image sensor). After choosing the level, press ENTER to confirm or ESC to keep the previous zoom level. ZM STAR tries to use the position of the brightest star in the NexGuide's field of view as the center of the zoomed image, unless the star is too close to the edge of the image sensor. ZM CTR always zooms at the center of the image sensor.
- **Lock Menu**–This submenu locks (or re-locks) a star in NexGuide's field of view for later guiding operation. After entering this submenu, use the UP/DOWN buttons to choose from the following options and then press ENTER or LEFT button to confirm. The current mode is displayed in the upper left corner of the LCD.
  - **Auto:** NexGuide will try to automatically lock onto the brightest star in the FOV.
  - **Manual/Re-Lock:** NexGuide will show a small pick-up crosshair in the image area of the LCD display. Use the four direction buttons to move the crosshair onto or near a star. Press ENTER to lock NexGuide on the star.
  - **Unlock:** NexGuide will exit from the locked guiding mode and return to preview mode.

- **Guide Menu**–This menu activates or de-activates autoguiding. Use the UP/DOWN buttons to choose from the following three options:
    - **Auto Cal:** NexGuide will start an auto-calibration routine prior to the start of autoguiding.
    - **Resume:** NexGuide will immediately re-start autoguiding with the previous guiding parameters.
    - **Stop:** NexGuide will stop autoguiding and return to the locked mode.
- **Cross Menu**–This menu displays the crosshair on the LCD screen. The center of the crosshair represents the center of the image sensor. The crosshair can also be used to roughly calculate the positioning of a star in the field of view.
- **Dec Backlash Menu**–To reduce the affect of Dec axis backlash during autoguiding, the NexGuide can send a signal to the Dec motors for a pre-determined time whenever the NexGuide reverses direction while guiding. When you select this menu, the current setting is displayed on the left side of the LCD screen. Use the UP/DOWN buttons to change the value. Press ENTER or LEFT to confirm. If your equatorial mount has no or minimal backlash, or if you have done very accurate polar alignment, the Dec backlash should be set to 0.

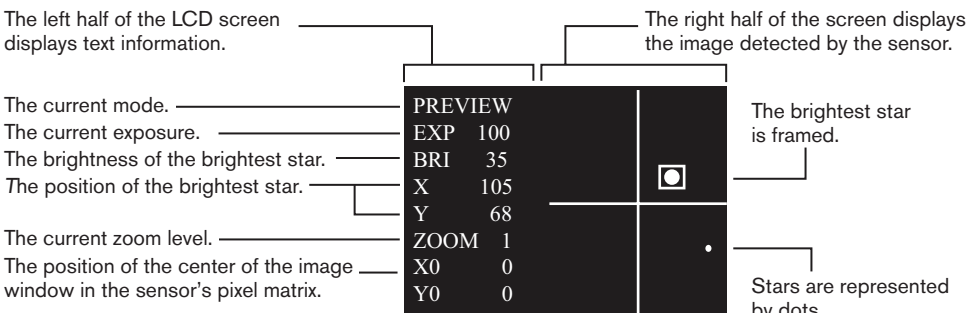
- **Noise Menu**–This menu sets the cut-off value for the noise filter of the image sensor. The proper noise level differs according to exposure time, so NexGuide provides independent noise level control for each exposure time and automatically uses the corresponding noise level when you change the exposure time. Once this submenu is selected, you will see the current cut-off value displayed in the text zone of the LCD and the image zone will continually refresh.
    - If you see a short solid horizontal line in the upper or middle portion of the LCD's image area, the cut-off value is too low and you should increase it until you can see reasonable amount of noise dots spread evenly in the LCD's image area.
    - If there is no noise spot in the image zone of the LCD, it might mean that the cut-off value is set too high. This could reduce the NexGuide's ability to detect faint stars. Reduce the cut-off value until you can see some noise dots diversify evenly in the image area.
    - **RESET Menu**–Returns all settings back to their factory defaults.

Preparing NexGuide

To get NexGuide ready for autoguiding, follow these steps:

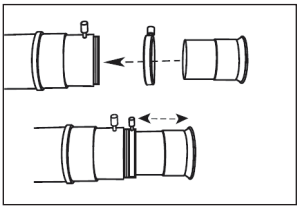
1. Adjust the focus (Preview Mode)
2. Align NexGuide's orientation with the R.A. and Dec axes of the mount
3. Find and lock a guide star (Locked Mode)
4. Start autoguiding (Guiding Mode)

Detailed instructions for each of these steps are provided below.



Adjusting Focus: Preview Mode

1. Insert an optical eyepiece into the eyepiece holder of the guide scope. Activate tracking on the mount and center a bright star in the eyepiece's field of view.
2. Remove the optical eyepiece, replace it with NexGuide, and power it on. NexGuide will automatically enter Preview Mode.
3. Use the +/- buttons to set the exposure time to 200 milliseconds.
4. Use the NOISE Menu to set the noise control level until the LCD is free of background noise.
5. Adjust the focuser of the guide scope until the image of the bright star appears in the LCD as a blank dot. Continue to adjust the focuser until the blank dot appears to be smallest, suggesting that the image is in focus. At this point, if you continue to turn the focuser you will see that the dot becomes larger again. The BRI reading will increase as the image comes into focus. If the BRI reading increases to over 253, use the +/- buttons to reduce the exposure time to avoid over-exposure.
6. Use the hand control on your equatorial mount to slowly move the star into the center of the image display area.
7. Use the ZM STAR menu to change the zoom level to show more details of the star image. Fine-tune the focuser to obtain the smallest star image and the highest BRI reading. Lock the focuser of the guide scope and remove the NexGuide.



Now it is time to make a parfocal eyepiece. This will come in handy when you want to find another guide star without changing the focus of the guide scope. Use the included parfocal ring to ensure the eyepiece is in focus with the autoguider.

1. Remove the autoguider from the guide scope.
2. Place the parfocal ring loosely around the eyepiece barrel.
3. Insert the eyepiece into the guide scope focuser. A crosshair or reticle eyepiece is recommended for precise centering of the guide star.
4. Slowly slide the eyepiece towards your eye until the star image is sharp. Do not move the focuser knobs. (Note: You may need to attach the 1.25” extension barrel to the eyepiece if the eyepiece is too short to reach focus.)
5. Slide the parfocal ring towards the focuser draw tube as far as it will go.
6. Use the thumbscrews on the ring to lock it in place. This will mark the correct focus position for that eyepiece.
7. Ensure your guide star is still centered and place NexGuide back onto the guide scope.

Aligning NexGuide’s orientation with the R.A. and Dec axes of your mount

1. Turn on the crosshair on the LCD screen using the Cross Menu.
2. Rotate the autoguider inside the focuser barrel so that when the equatorial mount is slowly slewing in RA axis the star image moves parallel to either the horizontal or the vertical line. Instead of using the hand control of the mount, you may use the LEFT/RIGHT direction buttons on the NexGuide to control the RA axis of the mount.

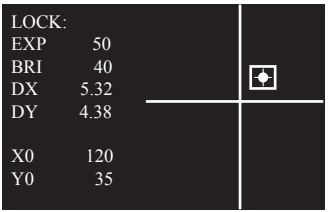
Remember to mark the position of the NexGuide on the guide scope, so you won’t have to perform the autoguider alignment again.

Finding and locking a guide star

1. Locate the celestial object that you will be imaging through your main telescope. Activate tracking on the equatorial mount. The guide scope should also be pointed to the same region in the sky.
2. Insert the parfocal eyepiece into the guide scope. Locate a bright star nearby and adjust the guide scope so the star appears in the center of the parfocal eyepiece.
3. Replace the par-focal eyepiece with NexGuide.
4. The image of the star should appear in the image zone of the LCD screen. If not, use the +/- buttons to increase the exposure time until the image of the star appears. (Note: Generally speaking, shorter exposure gives better periodic error correction results. The BRI reading on the screen is a good reference. The minimum BRI reading required for the NexGuide to work stably is 10. Try to bring the BRI reading to at least 10 for best results. Use the NOISE menu to filter out the noise if the image area of the LCD screen becomes blank or the background noise becomes too noticeable.)
5. Adjust the guide scope to bring the star to the center if it is too close to the edge of the image zone on the NexGuide. This is only necessary when the zoom level is set at 1.
6. Lock the guide star automatically or manually using the Lock Menu. When manually locking on a star, use the arrow button to position the small crosshair over the desired guide star. Press ENTER to manually lock on that star.

If the guide star is successfully locked, NexGuide will enter Locked Mode. The zoom level will automatically be switched to 4, and NexGuide will display an area of 64x64 pixels near the locked star. NexGuide will keep tracking the star as it slowly drifts away from its original position.

The diagram on the right is an example of the LCD display.



a. (DX, DY) are the locked star's offset to its original locked position.

b. (X0, Y0) are the position of the center of the image in sensor's pixel matrix.

c. If NexGuide loses the guide star, it will wait until the star reappears. Press ESC to return to Review Mode.

Autoguiding (Guiding Mode)

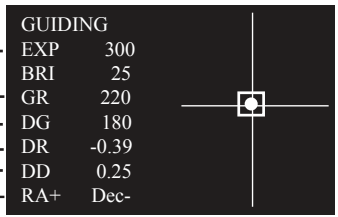
Once NexGuide is successfully locked onto a star, you may activate guiding with the Guide Menu.

Activate Autoguiding

- AUTO CAL: Auto Calibration is recommended whenever the telescope has been moved to a new object. An auto-calibration routine will detect the correct setting of the guiding parameters, including control signal polarity parameters, as well as the guiding aggressiveness for the RA and Dec axes. NexGuide will automatically start autoguiding after the calibration is complete.
- RESUME: This is to resume previous autoguiding. NexGuide will skip the auto-calibration routine and begin autoguiding with the previous guiding parameters.

OPERATING UNDER THE NIGHT SKY

The following diagram is what you will see in the GUIDING mode.



Exposure time

Brightness of the star

R.A. and Dec. guiding agressiveness in mS/Pixel

The drift in R.A. and Dec. in pixels

Indication that the SynGuider is sending RA+/RA- or Dec+/Dec- signals via the autoguider port.

A crosshair is displayed for you to monitor the effects of autoguiding. The center of the cross is the position of the guide star when guiding is activated.

Operations

The guiding aggressiveness of the RA or Dec axis can be increased or decreased with the direction buttons. Use the RIGHT/LEFT buttons to adjust the RA aggressiveness and the UP/DOWN buttons to adjust the Dec aggressiveness.

If the NexGuide loses the guide star during autoguiding it will prompt “STAR LOST.” Press ESC to return to Preview Mode and begin the auto calibration routine again.

To avoid creating any vibration that may interfere with guiding, place the control pad on a solid surface (such as your accessory tray) so that it does not hang directly from NexGuide.

Suspend Autoguiding

The exposure on your astroimaging camera should be stopped before suspending autoguiding. Use the Guide/Stop Menu to stop autoguiding.

SPECIFICATIONS

IMAGE SENSOR
Type: APTINA MT9V034C12STM CMOS Sensor
Chip size: 4.51mm(X) * 2.88 mm(Y)
Number of effective pixels: 752(X) * 480(Y)
Unit cell size: 6.0um(X) * 6.0um(Y)

POWER SUPPLY
DC 4.5V~14V, 150mA; a +5V power supply is recommended.
Power Jack: 2.1mm, tip positive; or USB type B

EXPOSURE TIME
2, 5, 15, 30, 70, 100, 200, 300, 400, 500, 600, 1200, 2000 mS

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(Products or instructions may change without notice or obligation.)

This product is designed and intended for use by those 14 years of age and older.

2-Year Warranty

This device complies with Part 15 of the FCC Rule. Operation is subject to the following two conditions:
1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operations.