Introduction

Congratulations on your AstroTrac 360 purchase! You are now the owner of the most portable high performance telescope mount available.

Your AstroTrac 360 breaks new ground by incorporating high precision miniature encoders at a cost far lower than previously possible with larger, heavier precision encoders. Integrated on-axis encoders enable highly accurate tracking and pointing. The encoders maintain accurate position even when the clutches are opened and the telescope moved by hand.

The patent pending modular design of the AstroTrac 360 system minimises travel weight. You can configure it as a single axis Tracker or a two axis Single Arm or German Equatorial mount to suit your imaging needs.

Each AstroTrac 360 Drive has built in WiFi, and a web server which sends the device independent control interface to a web browser running on your favourite WiFi enabled device. The control interface features a virtual handpad for slewing your AstroTrac 360, access to settings and updating of the firmware and user interface.

If you prefer not to use a computer under the night sky, your AstroTrac 360 also works in standalone mode, using the previously saved tracking and autoguiding settings on power up.
360 Drive Overview

- 3x Electronic Polarfinder Mounting
- 2x Dovetail Rail Stop Screws
- 2x Counterweight Bar Mounts
- 3x Polar Scope Adjusters
- ST-4 Guide Port
- 12 V DC Jack Socket (centre +ve)
- Dec Link
- Encoder Status Led
- Tracking Status Led
- GEM Configuration Dec Drive Interface and Location Dowel
- Wheel Guard
- Chassis
- Wheel
- Dovetail Rail
- General Status Led
- Polar Scope Slot
- Clutch Lever (shown in closed position)
# Configuring your AstroTrac 360

When using your AstroTrac 360 for the first time, you may find the below table useful as a starting point for choosing an AstroTrac 360 configuration suitable for your camera and lens/telescope:

<table>
<thead>
<tr>
<th>Focal Length (mm)</th>
<th>Recommended Configuration</th>
<th>Instrument Mounting Method</th>
<th>Autoguiding</th>
<th>Counterweights</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200</td>
<td>Tracker</td>
<td>First OmniClamp mounted to Drive Dovetail Rails. Single Camera: ballhead mounted to first OmniClamp. Two cameras: second OmniClamp mounted back to back with first. Two ballheads and cameras mounted on Vixen Dovetail Bar.</td>
<td>RA only</td>
<td>None</td>
</tr>
<tr>
<td>200 - 400</td>
<td>Single Arm</td>
<td>OmniClamp mounted to Dec Drive Wheel. Camera lens foot mounted to Vixen Dovetail Bar.</td>
<td>RA &amp; Dec</td>
<td>None</td>
</tr>
<tr>
<td>&gt; 400</td>
<td>German Equatorial</td>
<td>OmniClamp mounted to Dec Drive Wheel. Telescope mounted to Vixen Dovetail Bar.</td>
<td>RA &amp; Dec</td>
<td>Required</td>
</tr>
</tbody>
</table>
360 Edition Wedge

Overview

Your 360 Edition Wedge provides a rigid mounting for your AstroTrac 360, with fine adjustment for accurate polar alignment. Your Wedge covers the full 90 degree latitude range from pole to equator.

Mounting to your tripod

You can mount your Wedge on a photo tripod standard 3/8"-16 UNC camera thread.

Mounting to your pier

If you already own an AstroTrac TP3065 Pier you can securely mount your Wedge to it using 3x M8x8 mm socket countersunk screws.

Attaching your 360 Drive to your Wedge

Your AstroTrac 360 RA drive attaches to your Wedge with three M4x12 mm socket head cap screws. Alternatively, you can use the 360 Quick Release Kit which is available separately.
360 Edition Wedge

**Levelling**

Polar alignment is made easier by leveling the Wedge with the built in Bubble Level. Adjust the tripod leg lengths until the bubble is centered in the Bubble Level circle when viewed from directly above.

**Aligning North**

You can align your Wedge due north by sighting through the polar scope at night or by using a compass during the day. Rough alignment can be achieved by rotating your tripod.

To fine tune alignment, gently undo the two Front and the Rear Azimuth Lock Knobs a fraction of a turn until your Wedge can be rotated by turning the 2x Azimuth Fine Adjustment Knobs in opposite directions to each other. It is advisable to keep the Front & Rear Azimuth Lock Knobs slightly done up at all times to prevent wobble.
Setting your Latitude

1. Release the Latitude Lock Lever

2. Locate and loosen the Latitude Coarse Adjust Set Screw (accessible through hole in side plate)

3. Rotate the 360 Drive Mounting Plate until the Latitude Scale pointer is indicating your latitude:

4. Gently tighten the Latitude Coarse Adjust Set Screw until resistance is felt. Be careful not to overtighten or you may damage the thread.

5. Make fine adjustments in latitude using the Latitude Fine Adjust Knob. Gently tighten the Latitude Lock Lever when you are finished.
360 Edition Wedge

Attaching your AstroTrac 360 RA drive

A. With the supplied 3x M4 mm screws

Use the 3x M4 mm socket head cap screws and hex wrench to attach your AstroTrac 360 RA drive to the 360 Drive Mounting Plate.

(hint: adjusting the Wedge latitude to the equator zero degrees latitude position before inserting the screws gives better access)
360 Edition Wedge

Attaching your AstroTrac 360 RA drive

B. With the optional Wedge Quick Release Kit

1. Remove the 4x M4x12 mm hexagon socket head screws securing the 360 Drive Mounting Plate.

2. Attach the Quick Release Kit Dovetail Plate with 4x M6x16 mm hexagon socket countersunk screws.

3. Locate the 2x M4x12 mm hexagon socket head Stop Screws to prevent the OmniClamp sliding off the Dovetail.

4. Attach the OmniClamp to the 360 Drive Wheel with 4x M5x10 mm hexagon socket countersunk screws.

5. Slide the OmniClamp onto the Quick Release Kit Dovetail Plate until it contacts the 2x M4 Stop Screws.

6. Tighten the OmniClamp Lock Knob. Insert the hex key through the OmniClamp Lock Knob through hole to provide more leverage and tighten firmly.
Tracker Configuration

1. Mount your AstroTrac 360 Drive on your Wedge with the Chassis vertical (to reduce risk of gear falling off!)

2. Release the OmniClamp Lock Knob and slide your OmniClamp onto the Dovetail Rails.

3. Screw your ball head firmly onto the ⅜-16 OmniClamp stud.

4. Open the RA Drive Clutch and rotate the RA Drive so it’s horizontal. Balance your camera and lens by sliding the OmniClamp along the Dovetail Rails. Use a hex key through the cross bore in the OmniClamp Lock Knob to ensure the OmniClamp can’t slide off.

5. Follow the polar alignment procedure as described in the Polar Alignment section.

6. By mounting a second OmniClamp back to back with the first OmniClamp, it is possible to use a Vixen dovetail bar to mount two or more ballheads and cameras.
Drive Clamps

The Drive Clamps are used to mount the Dec Drive to the RA Drive in the Single Arm and German Equatorial configurations as follows:

1. Rotate the RA Drive so its vertical. Close the Clutch and ensure the 2x M3 hex socket head Rail Stop screws are in place to prevent the Dec Drive accidentally sliding off.

2. Ensure the 3x M5 hex socket countersunk Drive Clamp Lock Screws are loosened one full turn on each Drive Clamp. If the Drive Clamp is tight getting it started on the Dovetail Rails, use a little light lubricant.

3. The Drive Clamp/Dovetail Rail fits are closely toleranced. If you feel jamming, don’t force them. Apply lubricant and gently wiggle until the Drive Clamps slide onto the Dovetail Rails.

4. Once you’ve mounted the Dec Drive to the Drive Clamps, you can gently tighten the Drive Clamp Lock screws, ensuring the hex key is fully engaged with the hex socket in the head of the 3x M5 hex socket countersunk Drive Clamp Lock screws. Don’t over tighten or you may strip the hex socket in the head of the screw which will make removal and replacement difficult.
Single Arm Configuration

1. Rotate the RA Drive so it’s vertical and attach a pair of Drive Clamps to the RA Drive (see Drive Clamp section), leaving the Drive Clamp Lock Screws a little loose.

2. Slot the Dec Drive down into the Drive Clamps until the end of the Dec Drive touches the RA Drive.

3. Whilst holding the Dec Drive to prevent it sliding off the RA Drive, open the RA Drive Clutch, and rotate the RA Drive through 90 degrees until it is horizontal.

4. Slide the Dec Drive to and fro along the RA Dovetail Rails until your camera and lens is balanced in RA.

5. Gently tighten the Drive Clamps Lock screws (see precautions in Drive Clamp section).

6. Attach an OmniClamp to the Dec Drive Wheel.

7. Mount your camera and lens on a Vixen Dovetail Plate and clamp with the Dec Drive OmniClamp.

8. Open the Dec Drive Clutch, rotate the Dec Drive Wheel until your camera and lens is horizontal and balance by sliding to and fro in the OmniClamp. Once balanced in Dec, firmly lock the OmniClamp.
German Equatorial Configuration

Mounting the RA Drive

1. Mount a 360 Drive on your Wedge with the Chassis vertical (to prevent the Dec Drive accidentally sliding off whilst you are mounting it).

2. Screw both Counterweight Bars into the M10 threads at the Polar Scope end of the RA Drive Chassis.

3. Loosen the Counterweight Lock Screws and slide the Counterweight onto both Counterweight Bars.

4. Whilst holding the Counterweight, screw both Counterweight Bar End Stops into the ends of the Counterweight Bars.

5. Slide the counterweight so it touches the Counterweight Bar End Stops.
German Equatorial Configuration

Mounting the Dec Drive

1. Attach a pair of Drive Clamps to the RA drive (see Drive Clamp section), leaving the Drive Clamp Lock Screws a little loose.

2. Position the Drive Clamps so they are protruding a little from the GEM Interface end of the RA Drive.

3. Slide the Dec Drive Dovetail Rails down into the Drive Clamps until the Dec Drive GEM Interface is about 10 mm away from the RA Drive.

4. Simultaneously slide the Dec Drive down and towards the RA drive (as shown by the dotted arrows) so the GEM Interface Location Dowels go into their respective mating holes in the other Drive.

5. It may be necessary to gently wiggle the Dec Drive and Drive Clamps to get the Location Dowels into their respective holes.

6. Ensure the Dec and RA Drive GEM Interfaces are in full contact and gently tighten the Drive Clamp Lock Screws (see precautions in Drive Clamp section).

7. Attach an OmniClamp to the Dec Drive Wheel.
German Equatorial Configuration

Balancing the RA and Dec Drives

1. Place the RA Drive and Counterweight Bars into a vertical position and close the RA Clutch (page 13).

2. Place the Dec Drive OmniClamp in a horizontal position and close the Dec Clutch (this page).

3. Attach your camera and telescope to a Vixen Dovetail Bar. Slide the Vixen Dovetail Bar into the Dec Drive OmniClamp. Tighten the OmniClamp Lock Knob and check your telescope is secure.

4. Whilst holding your telescope, open the RA Clutch, and rotate the RA Drive through 90 degrees until the Counterweight Bars are horizontal.

5. Slide the Counterweight along the Counterweight Bars until your camera and telescope are balanced in RA. Close the RA Clutch.

6. Open the Dec Drive Clutch. Rotate the Dec Drive Wheel until your camera and telescope are horizontal and balance by sliding to and fro in the OmniClamp. Insert a hex key through the OmniClamp Lock Knob and use it as a lever to tighten the Knob (page 9).
360 Polar Scope Overview

For high quality unguided tracking (without ST-4 autoguider) and guided tracking (with ST-4 autoguider), you will need to align your AstroTrac 360 RA Drive’s axis of rotation with the axis of rotation of the sky. This process is known as polar alignment and achieved by adjusting your Wedge in azimuth and altitude.

There are no stars exactly coincident with the north and south celestial poles. The AstroTrac 360 Polar Scope reticle has been designed to make it easy to polar align using stars close to the celestial poles.

Polar alignment accuracy depends on focal length and exposure duration. As a rule of thumb, it’s advisable to aim for polar alignment accuracy of 5 arcminutes or better for trail free images.

For unguided long duration (> 5 mins), long focal length (> 200 mm) exposures, it is advisable to use an electronic polar alignment aid, such as a Polemaster camera or SharpCap software. Polar alignment within a few arcseconds then becomes possible.

Alternatively, autoguiding via the ST-4 port will eliminate small polar alignment errors, but it’s still important to achieve polar alignment accuracy of 5 arcminutes or better for good results.
360 Polar Scope Installation

1. Adjust the three Polar Scope Thumbscrews so they are protruding into the Polar Scope Slot by no more than 0.25 - 0.5 mm.

2. Locate the Polar Scope Washer in the slot and push until there’s a click. Ensure the Polar Scope Body is concentric with the Polar Scope Recess.

3. The Polar Scope should click into place and rotate without excessive force. If it feels tight, back off the three Polar Scope Thumbwheels a little, maintaining contact between the tips of the thumbscrews and the Polar Scope Mounting Disc.

4. It is advisable to rotate the Polar Scope by gripping and turning the Polar Scope Body. Rotating the objective lens tube may cause it to unscrew from the Polar Scope Body.

5. With the Polar Scope illumination on (see Control section), the reticle markings will illuminate red in low ambient light levels.

6. There’s no need to remove the Polar Scope when not in use, it can be left in place and its mass will help counterbalance your camera and lens/scope.
360 Polar Scope Setup

Centering The Reticle

For accurate polar alignment, the Polar Scope Reticle must be centered on the Polar Scope’s optical axis:

1. Mount your 360 RA Drive on your Wedge and install the Polar Scope as described in the previous section.

2. Look through the Polar Scope and identify the central point in the reticle pattern where the radiating lines intersect. This is the reticle centre.

3. Align the reticle centre on a distant fixed object. Use a faraway object during the day, or a star at night.

4. Close the RA Drive Clutch so the Drive Wheel doesn’t rotate, and gently rotate the Polar Scope through 180 degrees in it’s housing. If the reticle isn’t centred with the optical axis of the Polar Scope, the reticle centre will move off the distant object.

5. Adjust the three reticle centering screws in **small steps** to **halve** the offset distance of the distant object from the reticle centre.

6. Repeat steps 4 & 5 until the reticle is centred.
360 Polar Scope Setup

RA Axis Alignment

For accurate polar alignment, the Polar Scope’s optical axis must be aligned with the RA Drive’s axis of rotation. It may save you time if you carry out this procedure immediately after centering the polar scope reticle:

1. Mount your 360 RA Drive on your Wedge and install the Polar Scope and centre the reticle as described in the previous sections.

2. Align the reticle centre on a distant object. Use a point like feature during the day, such as the tip of a pylon, or a star at night.

3. Release the RA Clutch and rotate the RA Drive through 180 degrees. Re-engage the RA Clutch.

4. If the distant object has moved off the reticle centre, adjust the 3x Polar Scope Thumbscrews so as to halve the offset distance.

5. Repeat steps 3 & 4 until the offset is eliminated and the distant object remains at the reticle centre.
360 Polar Alignment

Northern Hemisphere

1. With one eye looking through the Polar Scope at the Ursa Major and Cassiopeia reticle marks, and the other eye looking directly at the sky, rotate the Polar Scope until the Ursa Major and Cassiopeia reticle marks are roughly aligned with the sky (neither constellation will be visible through the Polar Scope).

2. Adjust your Wedge Azimuth and Altitude Fine Adjust Knobs to position Polaris in the gap in the line marked ‘POLARIS’.

3. For longer focal lengths you can fine tune polar alignment by placing the stars 51 Cephei and Delta Ursa Major into the positions labelled ‘51 Cep’ and ‘δ UMi’ respectively.

4. The lines radiating from the reticle centre represent the year 2000, the next short line 2015 and the final short line 2030. If the current year falls between pairs of lines, position the stars correspondingly: e.g. in 2020, position the stars ⅓ of the distance from the 2015 line to the 2030 line.

5. Use small rotations of the Polar Scope and adjustments to the Wedge azimuth and altitude.
360 Polar Alignment

Southern Hemisphere

1. With one eye looking through the Polar Scope at the Southern Cross and Alpha Eridani reticle marks, and the other eye looking directly at the sky, rotate the Polar Scope until the Southern Cross and Alpha Eridani reticle marks are approximately aligned with the sky (neither will be visible through the Polar Scope).

2. Adjust your Wedge Azimuth and Altitude Fine Adjust Knobs to position Epsilon Hydri in the circle near the α Eri reticle mark.

3. For longer focal lengths you can fine tune polar alignment by placing Sigma Octantis and Chi Octantis into the cross marks labelled ‘σ Oct’ and ‘χ Oct’ respectively.

4. Use small rotations of the Polar Scope and adjustments to the Wedge azimuth and altitude to fine tune your polar alignment.
Powering Up

**Power Supply**
Your AstroTrac 360 Drives require a 12 V DC power supply capable of providing approximately 0.25 Amps per Drive for several hours. A 7.2 Ah lead acid gel battery is ideal.

If you are using an AC-DC converter, please ensure you use a regulated switch mode model with an inline fuse rated at 1 A.

The DC jack on each AstroTraac 360 Drive is centre pin positive.

**RA Drive**
Plug the DC jack plug into the RA Drive DC Jack Socket and give the RA Drive 5 seconds to boot. The last saved settings will load from memory and the drive will automatically start tracking at the if the tracking rate is other than zero. Ensure the RA Drive Clutch is closed otherwise the servo warning light will flash.

**Dec Drive**
When you are working with the Single Arm or GEM configurations, always power up the RA Drive first, then use the supplied Link Cable to connect the Dec Drive to the RA Drive. The Dec Drive will automatically configure itself as a Dec Drive on powering up.
Autoguiding

When you are working at longer focal lengths, you may find it helps to use an autoguider to compensate for residual polar alignment errors (and to a minor degree, axis non-perpendicularity, misalignment of telescope optics and atmospheric refraction). Your AstroTrac 360 Drive has an autoguider port into which you can plug an ST-4 compatible autoguider (RJ11 connector).

If you are using both the RA and Dec Drives in Single Arm or GEM configurations, the Dec autoguiding signals are sent from the RA Drive to the Dec Drive over the link cable.

**Important: connect your ST-4 compatible autoguider to the RA Drive BEFORE Powering Up. This is to ensure correct operation of the ST-4 interface.**

You can check that autoguiding is working using the ‘Manual Guide’ option in PhD2 Autoguiding software or an autoguiding box such as Shoestring Astronomy’s GPUSB.

See the User Interface Tracking Algorithm Section on page 27.
WiFi Control

Connecting to your AstroTrac 360
Most WiFi enabled devices can only connect to one WiFi network at a time. Once you’ve connected to the RA Drive network, the RA Drive handles communication with the Dec Drive over the Link Cable between the RA and Dec drives.

1. Power up the RA and or Dec Drives (as described in the Powering Up section)

2. Your AstroTrac 360 Drives will show up as WiFi networks (‘hotspots’) on your WiFi enabled smart phone/tablet/computer.

3. The 360 Drive WiFi network names are formatted as follows: drive type : axis type : ip address

4. For telescope control, connect to the RA Drive.

5. To update a Drive’s User Interface or firmware files, connect to the RA or Dec Drive as required.

6. Open a Google Chrome web browser and enter the Drive’s IP address. The Drive’s built in web server should serve the User Interface web page to your device. You can then control your telescope, change the Drive’s settings, or update files.
User Interface

Home Page
This is the main page for controlling your AstroTrac 360 Drives during an imaging session.

Virtual Handpad
The North, East, South and West Slew Buttons move the telescope at the speed set by the Slew Speed Slider.

Maximise Button
Resizes the page to fill your screen (functionality not available on iOS devices).

Console
Displays messages between the User Interface and your AstroTrac 360 Drives as well as helpful status information.

Command Line
Reserved for future features.
User Interface

Settings Page
When you make changes on this page they are stored in your 360 Drive’s memory and will be automatically re-loaded when the drive is next powered up. This allows you to use your AstroTrac 360 Drives without a computer.

Polar Scope LED
The Polar Scope Leds are built into the Drive Chassis and illuminate the Polar Scope Reticle, eliminating the need for a separate Polar Scope illuminator and batteries. The Dec Drive Leds are automatically disabled. The RA Drive LED brightness can be set from zero (off) to maximum.

Tracking LED
The tracking Led brightness steadily rises and falls (‘breathes’) when the RA Drive is tracking. The brightness can be set from zero (off) to maximum.

Status LED
This Led will flash rapidly if the clutch is opened whilst the RA drive is tracking. The brightness can be set from zero (off) to maximum.

Buzzer volume
The buzzer volume can be set from zero (off) to maximum.
User Interface

**Tracking Rate**
Use Sidereal rate when tracking the stars, Lunar rate for tracking the moon, and Solar rate for tracking the Sun.

0.5x rate can be used for nightscape photography, blurring both the foreground terrestrial and background celestial subject matter equally.

**Hemisphere**
Set to North when you are above the equator in the northern hemisphere. Set to South when you are below the equator in the southern hemisphere.

**Tracking Algorithm**
You can experiment with two different tracking algorithms to find which works best for your imaging scenario:

1. **Fast servo**: this may work best with unguided tracking (no ST-4 input) at shorter focal lengths. Many small updates to tracking speed are made each second.

2. **Slow servo**: this may work best with an ST-4 autoguider at longer focal lengths. The effective gear ratio is measured over a period of several seconds and slightly adjusted if necessary.
User Interface

Maintenance

All maintenance functions work over WiFi and do not require a cable to be connected to your AstroTrac 360 Drives. The firmware is the software which runs in your AstroTrac 360 Drive. The User Interface is the software which runs in your web browser on your WiFi device. The maintenance options function as follows:

**Update File**
Uploads replacement User Interface HTML, CSS and Javascript files.

**Update Firmware**
Uploads a firmware .hex file to your AstroTrac 360 Drive. Ensure both the AstroTrac 360 Drive you are updating, and the device you are uploading the .hex file from, are connected to mains power supplies. If power is lost during firmware upload, it may corrupt the firmware file and result in a non-functioning AstroTrac 360 Drive.

**Get Encoder Signal Strength**
Requests the encoder readhead signal strength from your AstroTrac 360 Drive. The resulting percentage value is displayed in the Console Panel on the Home Page. In normal use the encoder signal strength should be greater than 90%.
Troubleshooting

Poor Tracking Performance
● Check all 360 Drive Clutches are fully closed.
● Check your instrument is balanced in RA & Dec.
● Check polar alignment with a drift test or polar alignment software.
● Check the 360 Drive Encoder Status Led is green.

Tracking Status Led Flashing
1. Check the Clutch is fully closed.
2. Check the Encoder Status Led is green.

Dec Drive Not Functioning Correctly
If the Dec Drive Link Cable is connected to the RA Drive when the RA Drive is powered up, the Dec Drive may not configure itself correctly as a Dec Drive. You can correct this issue by disconnecting the Link Cable from the Dec Drive, waiting for 5 seconds, then reconnecting the Link Cable to the Dec Drive.

Autoguiding Not Functioning Correctly
1. Ensure the ST-4 autoguider cable is connected to your AstroTrac 360 RA Drive before powering it up.
2. Check the output from your ST-4 autoguider. You can do this with the manual guiding option in most autoguiding software. Your AstroTrac 360 Drive’s General Status Led will illuminate when an ST-4 autoguiding signal is active.

User Interface Not Working
1. We recommend using a Google Chrome browser.
2. Check that your browser supports Web Sockets by visiting 'https://www.websocket.org/echo.html'.
3. Check that your WiFi device is connected to the correct AstroTrac 360 Drive WiFi network.
4. Check that you have entered the corrected AstroTrac 360 Drive ip address (see WiFi Control section).
5. If the User Interface Home Page loads but the virtual handpad Slew Buttons don’t work, copy the information in the Console Window and contact support.

Getting Help
Please check that you have followed the procedures in this User Guide before contacting support@astrotrac.com. To enable us to help you, please send a clear description of the problem, together with photos/video if possible. **Do not remove the plastic pcb or gearbox Drive covers as this will void your warranty.**

Please note that we are unable to support User Interface issues as there are virtually infinite combinations of user device, operating system and web browser. Furthermore, as the User Interface software runs in the browser, it’s possible for anyone to modify it, further increasing the number of potential variations.
## Specification

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount type (v1.0 software)</td>
<td>Equatorial</td>
</tr>
<tr>
<td>Astrophotography equipment payload</td>
<td>10 kg (excluding counterweights)</td>
</tr>
<tr>
<td>Weight</td>
<td>See next page</td>
</tr>
<tr>
<td>Power requirement</td>
<td>12 V DC, approximately 250 mA per 360 Drive</td>
</tr>
<tr>
<td>Maximum slew speed (v1.0 software)</td>
<td>3 degrees per second</td>
</tr>
<tr>
<td>Tracking rates (v1.0 software)</td>
<td>Sidereal, Solar, Lunar, 0.5x, Off</td>
</tr>
<tr>
<td>Autoguiding rates (v1.0 software)</td>
<td>0.1x Sidereal</td>
</tr>
<tr>
<td>Encoder resolution</td>
<td>0.18 arcseconds</td>
</tr>
<tr>
<td>Encoder accuracy</td>
<td>Less than 30 arcseconds over 360 degrees</td>
</tr>
<tr>
<td>Tracking accuracy</td>
<td>Typically 5 arcseconds over 15 minutes</td>
</tr>
<tr>
<td>360 Edition Wedge latitude range</td>
<td>0 to 90 degrees (equator to pole)</td>
</tr>
<tr>
<td>Electronic polar scope mount</td>
<td>3x M4 screw holes (48.0 mm PCD, 100 degrees apart)</td>
</tr>
<tr>
<td>Hand controller</td>
<td>Browser based software</td>
</tr>
<tr>
<td>WiFi</td>
<td>802.11b/g/n</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-10 to +35 Celcius</td>
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</table>
## Specification

<table>
<thead>
<tr>
<th>Component Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>360 Drive</td>
<td>1.85 kg</td>
</tr>
<tr>
<td>360 Edition Wedge</td>
<td>0.68 kg</td>
</tr>
<tr>
<td>OmniClamp</td>
<td>0.14 kg</td>
</tr>
<tr>
<td>Counterweight Bar with End Stop (each)</td>
<td>0.14 kg</td>
</tr>
<tr>
<td>Middle Counterweight</td>
<td>2.90 kg</td>
</tr>
<tr>
<td>Drive Clamp (each)</td>
<td>0.14 kg</td>
</tr>
<tr>
<td>Polar Scope</td>
<td>0.10 kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Configuration Weight</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracker (1x Drive, Wedge, OmniClamp, Polar Scope)</td>
<td>2.77 kg</td>
</tr>
<tr>
<td>Single (2x Drive, Wedge, OmniClamp, Polar Scope, 2x Drive Clamps)</td>
<td>4.90 kg</td>
</tr>
<tr>
<td>German (2x Drive, Wedge, OmniClamp, Polar Scope, 2x Drive Clamps, 2x Counterweight Bars, Middle Counterweight)</td>
<td>8.08 kg</td>
</tr>
</tbody>
</table>
Safety Warnings

Please follow these safeguards and use your AstroTrac 360 Drives properly to prevent injury, death and material damage:

Do not place fingers near the apertures in your AstroTrac 360 Drive Wheels when the 360 Drives are slewing as there is a risk of pinching or crushing as the 360 Drive Wheels rotate.

Keep your AstroTrac 360 Drives from the reach of small children.

Do not use any batteries, power sources, or accessories not specified in this User Guide.

Do not use any home-made or modified batteries.

Do not connect your AstroTrac 360 Drives to the power supply in reversed polarity (+ -). Do not mix new and old or different types of batteries.

Do not insert any foreign metallic objects into the electrical contacts of the AstroTrac 360 Drives, connecting cables etc.

Do not use the equipment where there is flammable gas. This is to prevent an explosion or fire.

Do not disassemble or modify the equipment.

Do not use solvents to clean the equipment as this may damage the finish.

Never look at the sun or extremely bright light source through a camera, lens or telescope. Doing so may damage your vision or permanently blind you.

Do not store your AstroTrac 360 Drives in dusty or humid places.

To prevent fire and electrical shock, follow the safeguards below:

- Always insert the power plug all the way in.
- Do not handle a power plug with wet hands.
- When unplugging a power plug, grasp and pull the plug instead of the cord.
- Do not scratch, cut, or excessively bend the power cord, or put a heavy object on the cord. Also do not twist or tie the cords.
- Do not use a cord whose insulation has been damaged.
Caring for your AstroTrac 360 Drives

Handling Precautions
Your AstroTrac 360 Drives are precision instruments. Do not drop or subject them to physical shock.

Do not overload your AstroTrac 360 Drives by operating them severely out of balance.

Your AstroTrac 360 Drives are not waterproof. If your AstroTrac 360 Drives get wet, place them in a warm dry location and let them dry out naturally. If your AstroTrac 360 Drives have been exposed to salty air, wipe with a well-wrung wet cloth.

Do not leave your AstroTrac 360 Drives in excessive heat such as in a car in direct sunlight. High temperatures can cause your AstroTrac 360 Drives to malfunction.

Your AstroTrac 360 Drives contains precision electronic circuitry. Never attempt to disassemble yourself.

Friction Drive Surfaces
Under normal operational conditions, your AstroTrac 360 Drives does not require maintenance. The on-axis Renishaw encoder enables the control software to continually compensate for any small variations in drive speed whilst tracking.

After extended use in very dusty conditions, it may be necessary to carefully remove the plastic Wheel Guards and gently clean the circumference of the Drive Wheels with a little Isopropyl Alcohol. This is best done with your AstroTrac 360 Drives slewing. Take care to ensure that fibres from your cleaning cloth do not get carried into the gearboxes.

Cleaning
You can clean your AstroTrac 360 Drives with a damp cloth. Do not use chemicals as they may damage the anodised metal and plastic surfaces. Do not submerge your AstroTrac 360 Drives in water as this will most likely cause permanent damage to the electronic components.

Warranty
DO NOT remove the protective pcb and gearbox covers or alter your AstroTrac 360 Drives in any way as this will void your warranty. If you have a problem, please email support@astrotrac.com for further assistance.