



MODERN GEARBOXES HAVE CHANGED THE RULES FOR TELESCOPE MOUNTS

UNDERSTANDING MODERN MOUNT TECHNOLOGY

In the first buying guide for mounts, we explored the different types of astronomical mounts and how to choose one that best suits your observing goals. In this guide we'll look a little deeper at the technology inside modern mounts, mechanical drive systems, and key features such as GoTo systems, tracking, and high-precision encoders.

BUYING GUIDE #4

This buyers guide is designed outline the key features incorporated in modern mounts.

While these features aren't essential for beginners, understanding how modern mounts work will help you make more informed purchasing decisions as your interests and equipment evolve.



EACH MOUNT OFFERS
A DIFFERENT BALANCE
BETWEEN PERFORMANCE,
PORTABILITY, AND COST

DRIVE SYSTEMS - I

WORM GEAR DRIVE

Worm gears have been the industry standard for decades and remain a common drive system used in astronomical mounts.

A precision-machined worm gear rotates a large gear wheel attached to each axis, allowing the telescope to move with exceptional precision. High-quality worm gears can support substantial payloads while providing the smooth tracking required for astrophotography.

- **ADVANTAGES**

Proven and reliable technology delivering good tracking accuracy. Well suited to heavy telescopes, and so ideal for permanent or semi-permanent installations.

- **DISADVANTAGES**

Generally larger and heavier, therefore less portable than newer designs. Small manufacturing imperfections can produce periodic tracking errors. May require occasional adjustment or maintenance.

BELT DRIVE

Many modern mounts incorporate timing belts between the motors and the worm gears. The belts help reduce backlash, smooth the transmission of power and produce quieter operation. Although they don't replace the worm gear itself, belt-drive systems have become increasingly common because they improve overall performance while requiring very little maintenance.



REDEFINING PORTABLE
ASTRONOMY

LIGHT AND COMPACT
WITH AN AMAZING
PAYLOAD CAPACITY

DRIVE SYSTEMS - II

STRAIN-WAVE (HARMONIC) DRIVES

In recent years, the most significant development in mount technology has been the introduction of strain-wave drive systems, or harmonic drives. Rather than relying on conventional worm gears, strain-wave drives use a completely different gear mechanism capable of producing extremely high torque in a remarkably compact package. This allows manufacturers to build mounts that are both lightweight and capable of carrying surprisingly heavy telescopes.

Many strain-wave mounts can operate without traditional counterweights when carrying moderate payloads, making them particularly attractive for astronomers who regularly travel to dark-sky locations.

- **ADVANTAGES**

Extremely lightweight and compact with a high payload capacity relative to their size. Often capable of operating without counterweights. Consequently, excellent portability.

- **DISADVANTAGES**

More expensive than conventional mounts. Tracking characteristics differ from worm gear systems and often benefit from autoguiding during long photographic exposures.



A TELESCOPE IS NO
LONGER JUST AN
INSTRUMENT - IT'S
PART OF A CONNECTED
ECOSYSTEM

COLD WINTER NIGHTS
ARE NOW OPTIONAL

KEY FEATURES

- **PORTABILITY**

The compact size, modest weight and high payload capacity of strainwave mounts makes them the ideal solution for amateur astronomers who are prepared to travel to darker skies. However, every mount has its limits. While it is possible to setup heavy duty mounts in the field to accommodate larger telescopes, remember that the best telescope is the one you use the most - this saying naturally extends to the mount given its critical role in a visual astronomy or astrophotography rig.

- **CONNECTIVITY**

Modern astronomical mounts are no longer isolated pieces of equipment. Many now support USB, Wi-Fi and Bluetooth connectivity, allowing them to communicate with computers, smartphones and tablets.

- **AUTOMATION**

Improved connectivity has further enabled integration with popular astronomy software, planetarium programs and astrophotography applications, allowing observers to control the entire telescope system from a single device, even remotely from anywhere in the world.

For astrophotographers, this level of automation can greatly simplify image acquisition and allow unattended imaging sessions throughout the night.



GOTO SYSTEMS

One of the biggest advances in amateur astronomy has been the widespread adoption of computerised GoTo systems. After a simple alignment procedure, a GoTo mount can automatically locate thousands of astronomical objects stored in a celestial database. Once selected, the mount slews to the object before automatically tracking it as the Earth rotates.

For newcomers, this can dramatically reduce the frustration of locating faint galaxies, nebulae and star clusters, particularly under light-polluted skies where many of the stars used for traditional star hopping are difficult to see. GoTo technology doesn't replace learning the night sky, but it does make astronomy considerably more accessible and allows observers to spend more time enjoying the sky rather than searching for objects.

TRACKING RATES

The Earth rotates continuously, so all celestial objects appear to move across the sky. Motorised mounts compensate for this movement by tracking at carefully controlled speeds. The most common tracking rate is the sidereal rate, which follows the apparent motion of the stars. Many mounts also provide lunar and solar tracking rates to accurately follow the Moon and Sun, whose apparent motion differs slightly from the background stars. These tracking modes improve both visual observing and astrophotography by keeping the chosen object centred within the eyepiece or camera for extended periods.



ROUND STARS DON'T
HAPPEN BY ACCIDENT

TRACKING ACCURACY

Tracking accuracy is one of the most important characteristics of any astronomical mount.

Even tiny mechanical imperfections become obvious during long photographic exposures, where a tracking error of only a few arc seconds may cause stars to appear elongated rather than perfectly round.

Modern mounts employ a variety of techniques to improve tracking accuracy, including precision machining, belt-drive systems, periodic error correction (PEC) or rely on autoguiding with a camera with a guide scope or off-axis guider (OAG). Together, these technologies allow today's mounts to achieve remarkable tracking performance that was once available only in professional observatories.



ENGINEERED FOR PRECISION ASTRONOMY

ENCODERS

Many premium astronomical mounts are fitted with Encoders. Precision sensors that measure the exact rotational position and movement of a telescope's axes. They allow the mount's computer to constantly track where it is pointing. Unlike a conventional motor system, which assumes the telescope has moved to the commanded position, encoders constantly verify where the telescope is actually pointing. This continuous feedback allows the mount to detect and correct even the smallest tracking errors while improving pointing accuracy.

Not all encoders work in the same way ...

RELATIVE ENCODERS measure movement from a known reference position. After the mount is switched on, it normally requires a homing or alignment procedure before it knows its exact position.

ABSOLUTE ENCODERS always know the precise position of each axis, even after the mount has been switched off or moved manually. This capability is one of the defining features of many premium observatory-class mounts, allowing them to resume operation without losing their positional reference.

Some mounts incorporate an encoder only on the Right Ascension (RA) axis to improve tracking accuracy. While premium models may include encoders on both the RA and Declination (Dec) axes for the highest possible tracking and GoTo precision.

Are Encoders Essential? No. Modern worm-driven and strain-wave mounts without encoders can produce outstanding photographs when combined with autoguiding.

ABOUT NSO

Our Vision

We envision a world where anyone with an interest in astronomy can begin their journey with confidence and enjoy rewarding first light experiences. Where choosing equipment is exciting rather than overwhelming, expert guidance is always within reach, and every astronomer has a trusted partner throughout their journey under the stars.

Our Commitment

We believe our responsibility doesn't end with a sale. We are committed to supporting our customers throughout their astronomy journey.

- Expert Guidance
- Carefully Selected Stock
- Accessible Value
- Long-Term Partnership

