

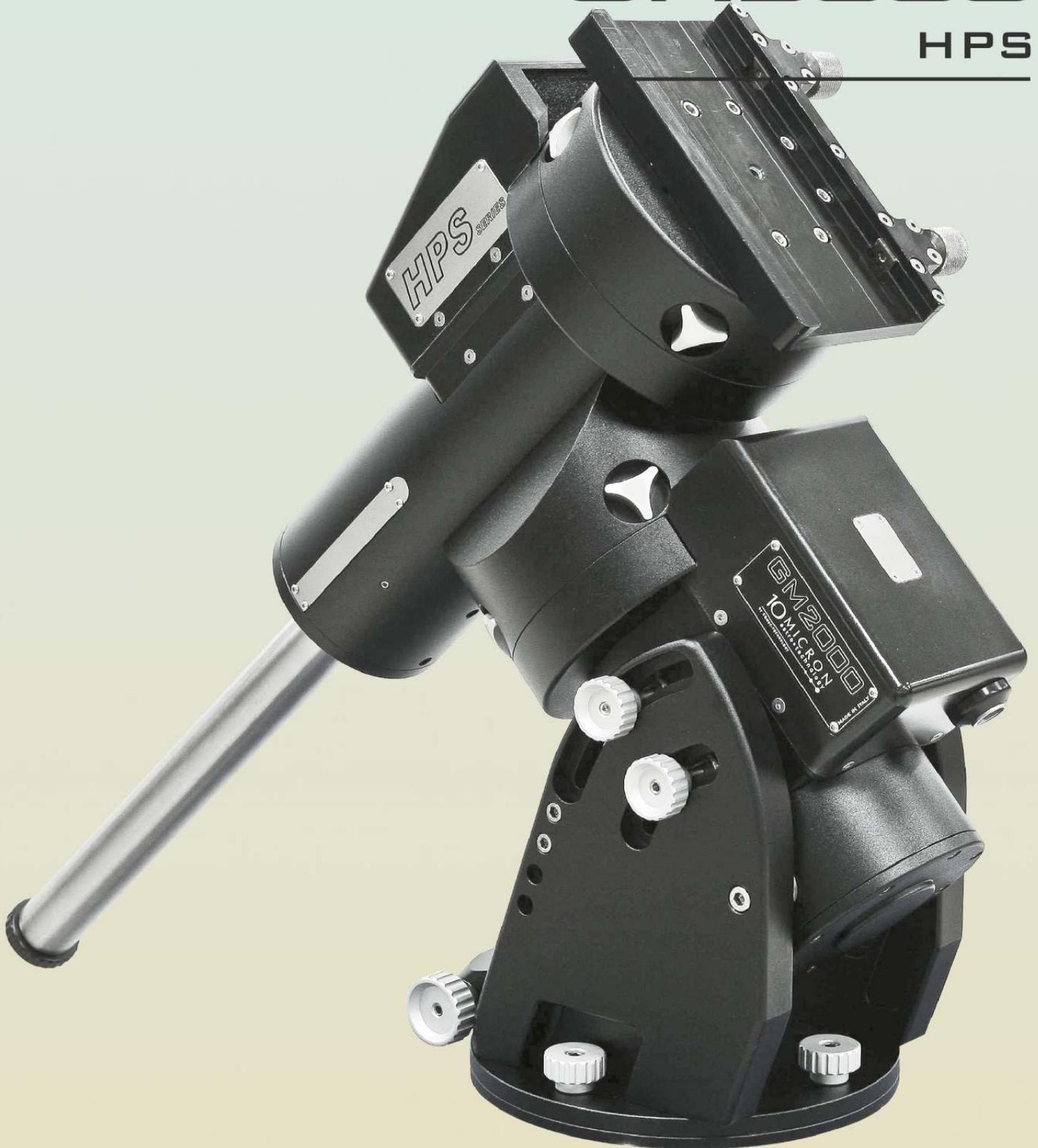
10 MICRON
astro•technology

by COMEC-TECHNOLOGY



GM2000

HPS



10MICRON: NO COMPROMISES

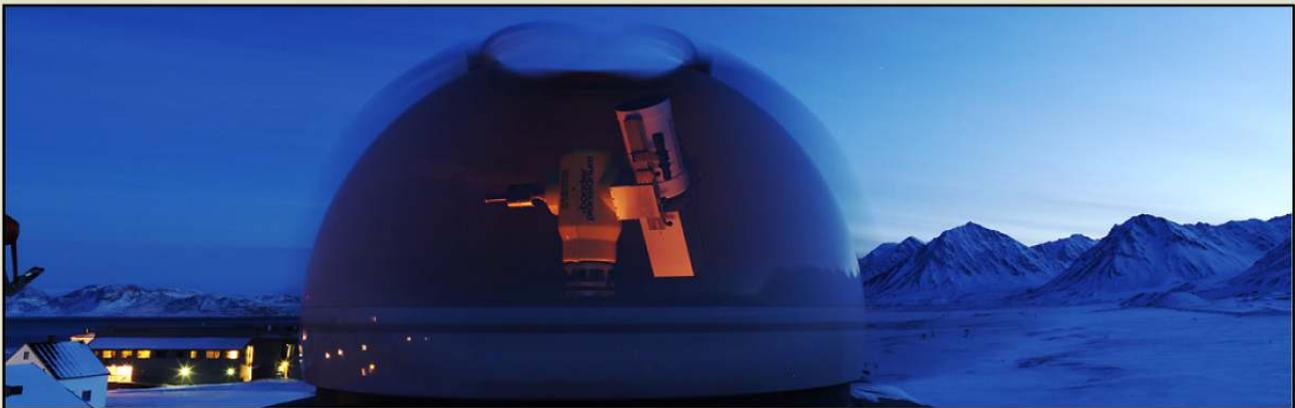
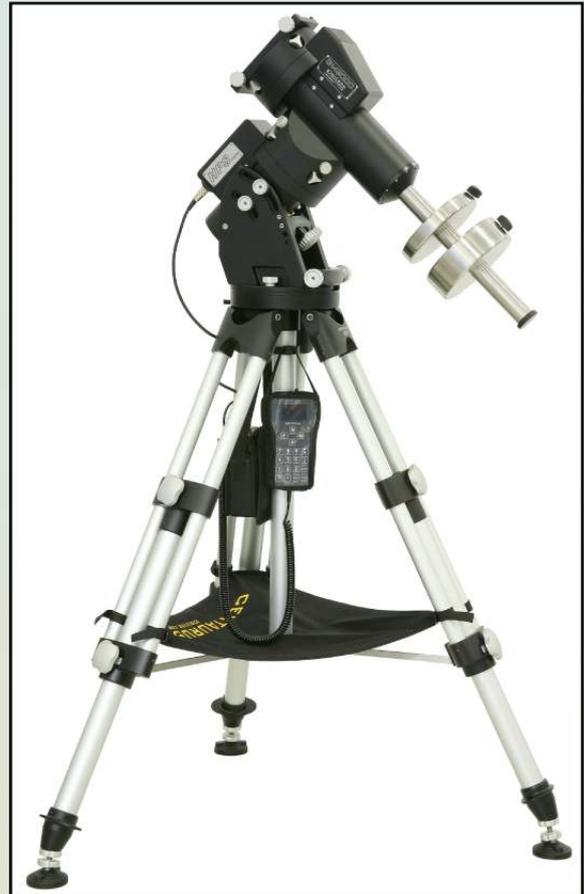
The development of 10micron products is aimed to provide both the best performances and the maximum ease of use.

The availability on the market of more and more advanced and flexible astronomical imaging systems opens new windows on the sky: today, ultra-high definition and ultra-high speed imaging is within the amateur's reach, way more than what was predictable ten years ago. 10micron's products evolved at the same pace, in terms of tracking and pointing accuracy and speed. The HPS series mounts are now at the peak of this process.

Every observer knows that when you are under the sky you have little time and each set up operation comes with the risk of compromising the night. Having excellent performance on paper means nothing if you need many complex set up operations before reaching it.

This is the reason 10micron mounts are designed around the user's needs, and not to enforce the mount's way of operation on them.

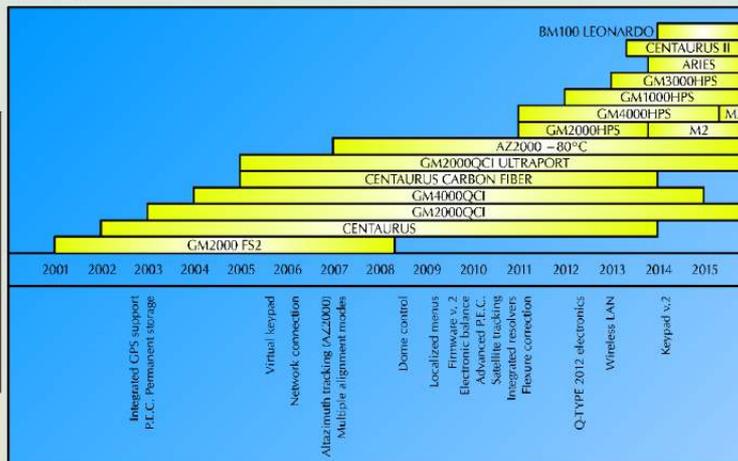
Now 10micron mounts are used in the open field as well as in remotized sites, in educational observatories as well in the extreme climates of northern Canada and Atacama desert.



TEN YEARS OF HISTORY

The experience of ten years in astronomical manufacturing.

The 10micron mount line was born in 2000 with the aim of providing high standard quality products: Equatorial mounts, altazimuth mounts and tripods always with the best performance.



The 10micron product range.

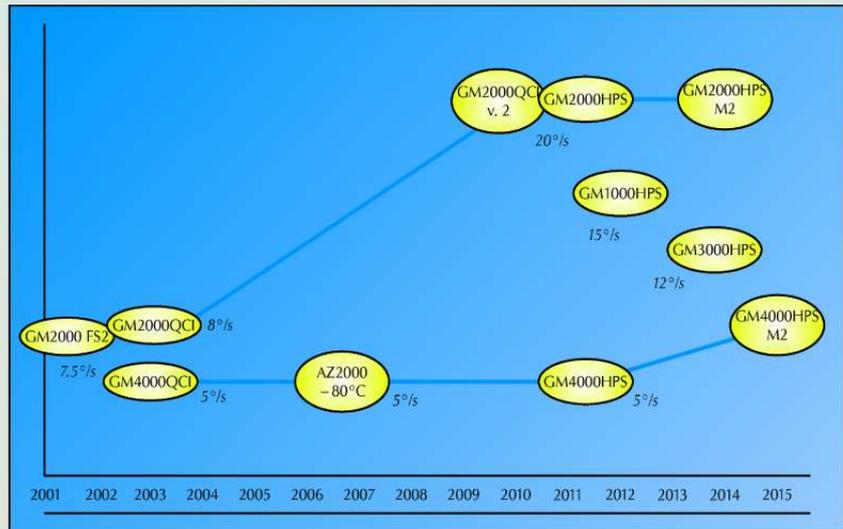
From the traditional german equatorial mounts GM2000 and GM4000, now also in the HPS version, to the special application AZ2000 altazimuth mount, and the new GM1000HPS and GM3000HPS mounts, the 10micron product range is dedicated to the most demanding observer.

PUSHING THE PERFORMANCE ENVELOPE

Always striving for the best performance.

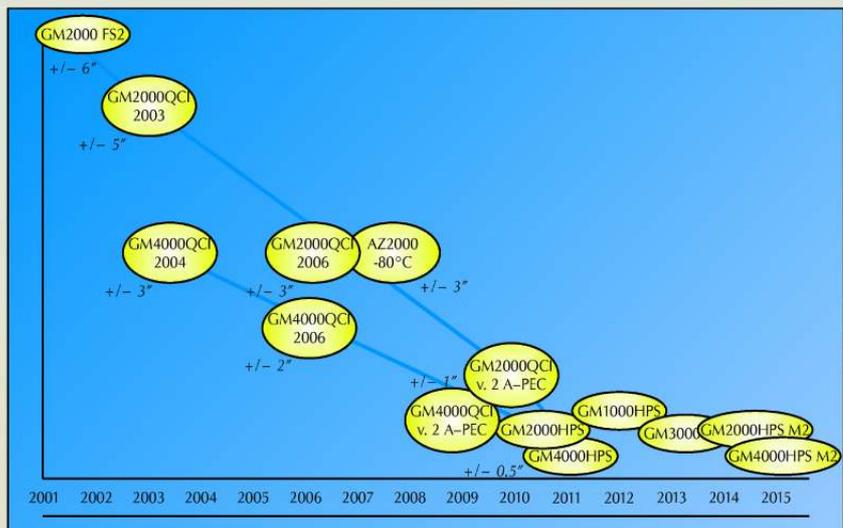
Two are the main numbers defining the performance of an astronomical mount: the tracking accuracy and the maximum slew speed. The constant technological evolution allows for improving these numbers continuously. From the first GM2000 mounts with stepper motors up to the new GM3000HPS, the tracking accuracy has been improved by an order of magnitude and the pointing speed has been improved by a factor of three.

An high pointing speed is required for many astronomical applications. Searching for supernovae, asteroids or exoplanets, where images of a large number of different objects are required in the minimum time, as well as tracking artificial satellites.



Pointing speed of 10micron mounts.

An excellent tracking accuracy is required instead for high-resolution deep-sky imaging, in order to simplify or completely get rid of complex autoguiding systems, which can be source of errors or breakdowns.



Tracking accuracy of 10micron mounts.

THE HPS TECHNOLOGY

HPS stands for High Precision and Speed, representing the essence of the new 10micron mounts. High precision, thanks to an innovative and exclusive absolute encoder paired with the 10micron manufacturing. High speed, thanks to high performance electronics and AC servo motors.

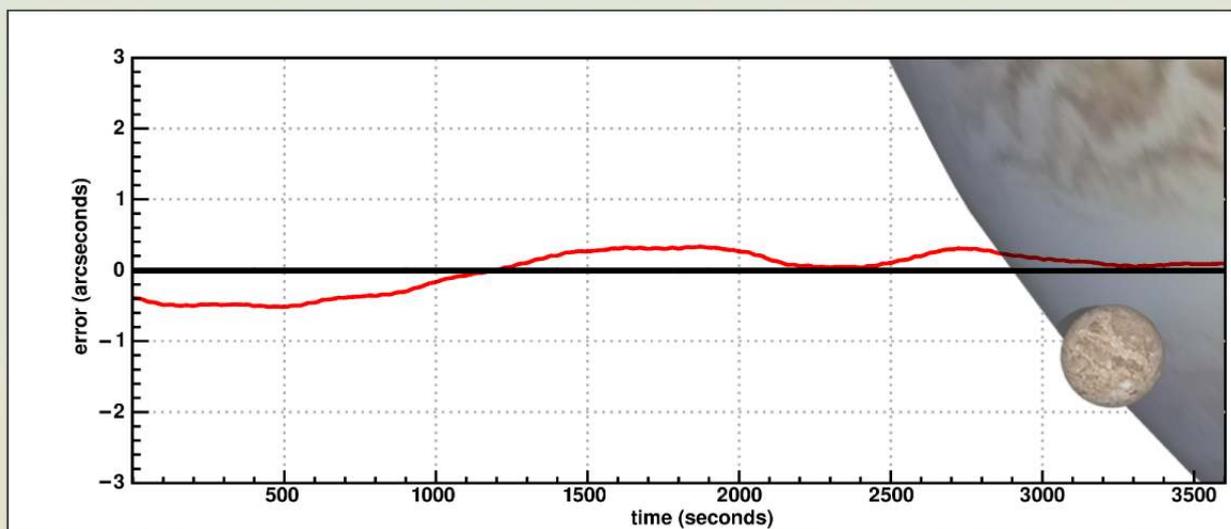
The HPS series mounts are equipped with a pair of absolute encoders with ultra-high resolution, directly mounted on the right ascension and declination axes.

This technology has been used already in the professional observatories, where the high cost and complexity are not an issue. Measuring directly the rotation angles of the axes allows to compensate the large part of the mechanical errors, such as periodic errors and transmission backlash. However, this requires systems with very high resolution.

In the past few years this technology is being found also in amateur astronomers' instruments, often paired with the use of *direct drive* technology, where motors are mounted directly on the mount's axes, without any mechanical reduction gearing.

While having some advantages, using a *direct drive* system implies also some drawbacks such as having axes less robust to external stresses like wind and greater power needs. For this reason, 10micron mounts continue to feature the traditional worm – wormwheel transmission.

The absolute encoders used in the HPS mounts have been specifically designed for this application. Beyond a resolution of the order of a tenth of an arcsecond, in this way we have also removed any need for homing or position-saving procedures.



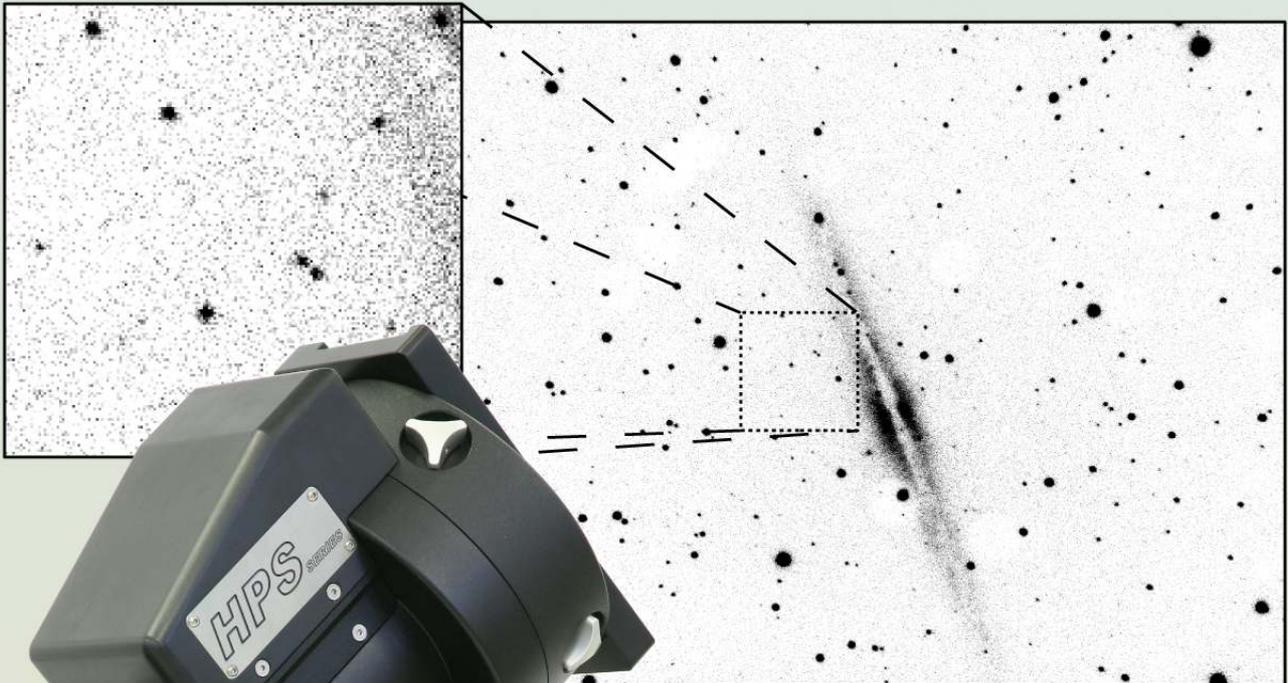
Tracking error profile measured with an encoder coupled to the r.a. axis. Jupiter and Ganymede are shown as they appear from Earth, at the same scale.

GM2000HPS

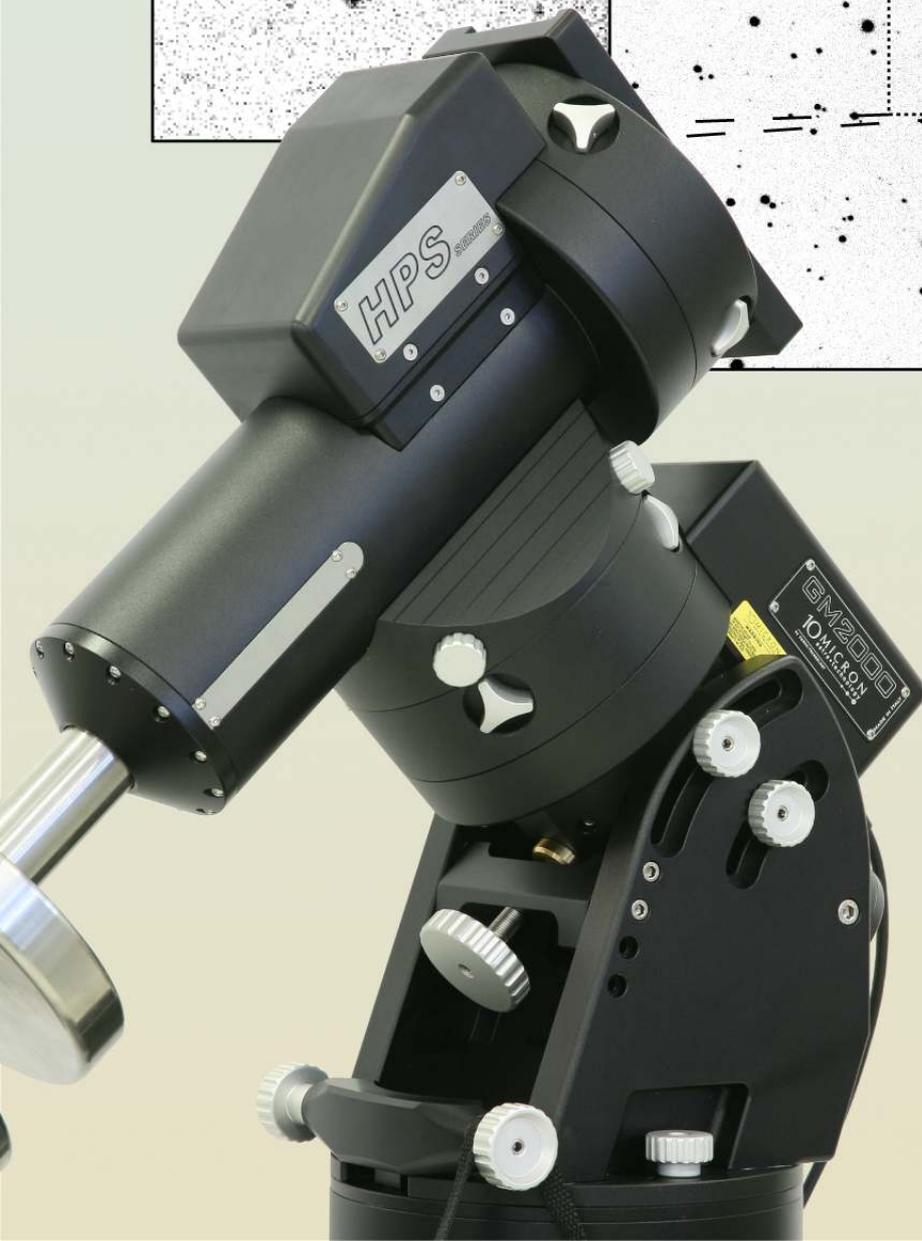
Evolving perfection.

The GM2000HPS mount, now in the new M2 version, is built for the demanding observer using photographic instruments up to a weight of 60kg – 130 lbs (counterweights not included).

Movements are driven by two AC servo motors, with timing belt reduction having zero-backlash. Both axes feature a classic worm – wormwheel pairing. The wormwheels are made of bronze (B14), with a diameter of 172mm and 215 teeth, while the worms are made of alloy steel with a diameter of 24mm. The axes themselves are made of 50mm diameter alloy steel, for the maximum rigidity.



NGC 891. Unguided exposure of 400s. Scale of 0.7"/pixel.





The connections of the control box.

The electronics is housed in an independent control box, easily removable. The connections of the mount and keypad feature security lock screws.

The mount can be controlled using the included keypad, without connecting an external PC. The keypad is built in order to maintain the maximum readability in all lighting conditions. Both the display and the ergonomic keys, allowing for the use of gloves, feature a red backlight. An heater keeps the display warm for usage below freezing temperatures.

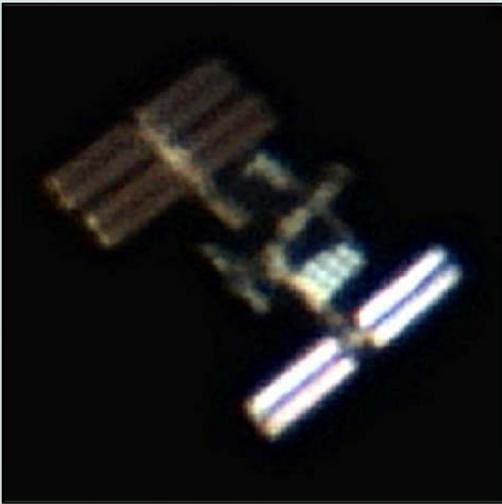
The mount can be controlled using the most common software packages by connecting it to a PC with the RS-232 serial port or the Ethernet connection, via the 10micron ASCOM driver or the Meade compatible command protocol. Furthermore, a dedicated software (also included with the mount) can be used to create a "virtual keypad" replicating exactly the functions of the physical keypad. The RS-232 port can also be used to control an external dome. This flexibility makes the GM2000HPS an ideal mount for observatories and remotized observing sites.

The object database contains many star catalogs and deep-sky objects up to the 16th magnitude. Solar system objects can be tracked so that their motion is compensated with respect to the stars. You may load orbital elements of comets, asteroids and artificial satellites into the mount, so that these objects can be tracked directly using the keypad (without any external PC).

Pointing is made accurate through the usage of a model containing up to 100 stars, which allows for the correction of the classical polar alignment and conic errors, and also of the most important flexure terms of the optical tube. In this way it is possible to obtain

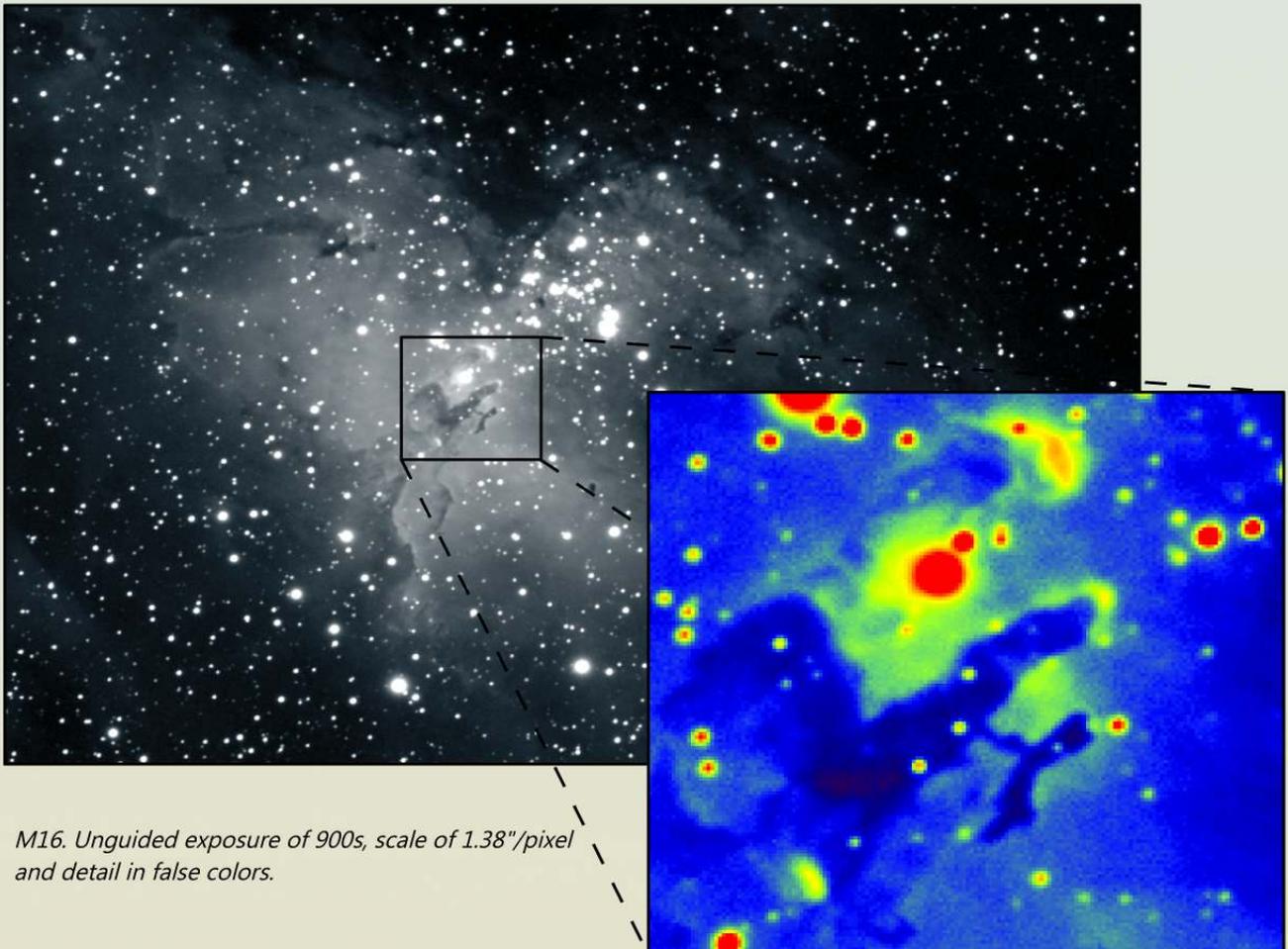


The ISS with a GM2000HPS.



pointing accuracies of the order of 20 arcseconds RMS. The same model can be used in order to obtain the maximum tracking accuracy, compensating also for the atmospheric refraction (depending on the local atmospheric pressure and temperature). A series of auxiliary functions is provided to help the user for quick aligning the mount to the celestial pole. You may also save and recover the alignment data of different observing sessions. This function is very useful if you have many instruments in different setups, each one requiring different flexure corrections.

Tracking through the meridian, a typical problem with german mounts, is solved allowing for tracking for up to 30° past the meridian (configurable), in both directions. In this way any object can be tracked for at least four hours.



M16. Unguided exposure of 900s, scale of 1.38"/pixel and detail in false colors.

GM2000HPS ultraportable version.

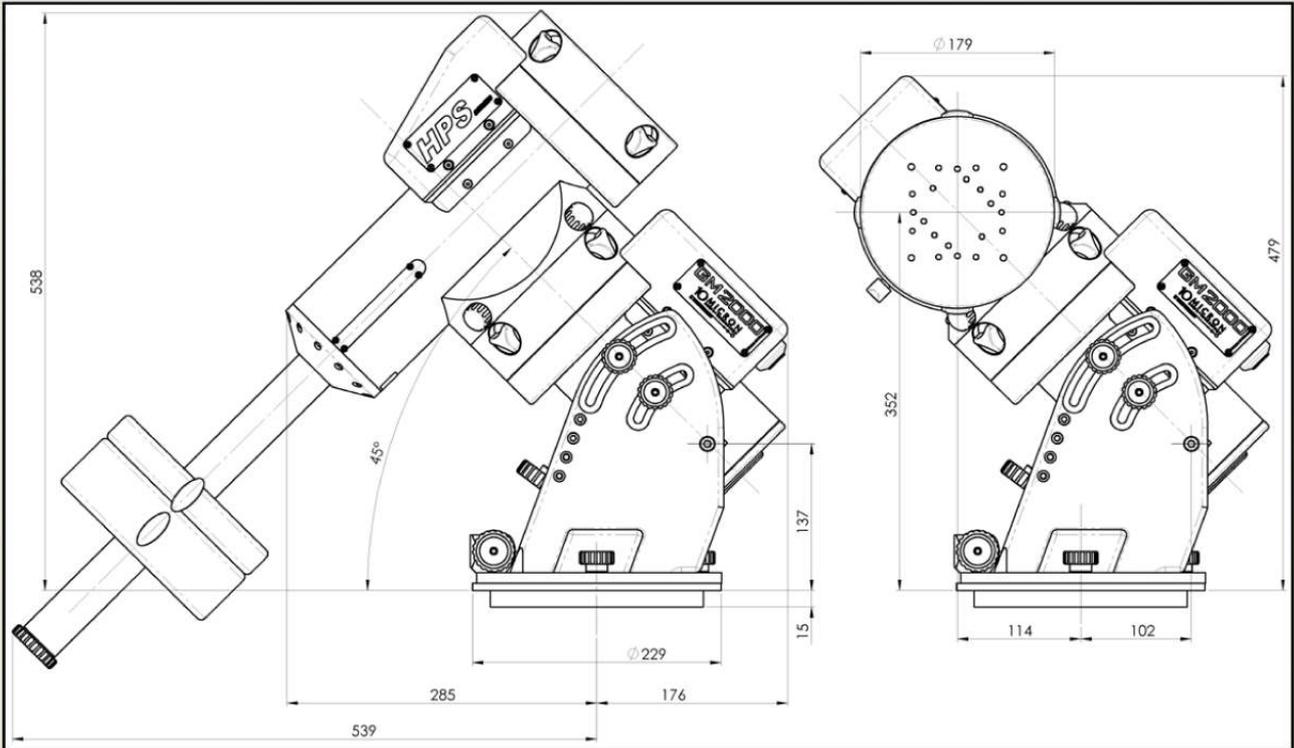


The tracking accuracy makes autoguiding not necessary for many uses. The absolute encoders on both axes allows to obtain a typical tracking error below 1 arcsecond. It is possible to autoguide anyway, using the ST4-compatible port or through the serial/Ethernet connection, with a guide rate configurable from 0.1x to 1x. The guide rate can be automatically corrected for the declination of the target, so that there is no need of recalibrating the autoguide when observing at different declinations.

Among the other functions, you will find the electronically-assisted balance and the ability of parking the mount in different user-defined positions.

Designed for field use, the *ultraportable* version is easily divided into two parts. All electrical connections are made automatically when assembling the mount. The biggest piece has a weight of only 18.5 kg – 41 lbs, and in combination with the Centaurus II (21 kg – 46 lbs) you obtain a winning combination for the mobile observer.

Size of ultraportable version at a latitude of 45° (mm).



TECHNICAL DATA SHEET

| | |
|--|--|
| Type | German Equatorial Mount |
| Weight (mount) | 33 kg – 73 lbs without accessories |
| Weight, Ultraportable version (mount) | 18.5 kg – 41 lbs + 15 kg – 33 lbs without accessories |
| Instrument payload capacity | 50 kg – 110 lbs |
| Latitude range | 20° – 70° |
| Azimuth fine adjustment range | +/- 10° |
| Counterweight shaft | 40 mm diameter, stainless steel, weight 4 kg – 9 lbs |
| Axes | 50 mm diameter, alloy steel |
| Bearings | Pre-loaded tapered roller bearing |
| Worm wheels | 215 teeth, 172 mm diameter, B14 bronze |
| Worms | diameter 24mm, tempered alloy steel, grinded and lapped |
| Transmission system | Backlash-free system with timing belt and automatic backlash recovery |
| Motors | 2 axes AC servo brushless |
| Power supply | 24 V DC |
| Power consumption | ~ 0,7 A while tracking ~ 3 A at maximum speed ~ 5 A peak |
| Go-to speed | Adjustable from 2°/s to 20°/s |
| Pointing accuracy | < 20" with internal multiple-stars software mapping |
| Average tracking accuracy | < +/- 1" typical for 15 minutes (< 0.7" RMS) with internal multiple-stars software mapping and compensation of flexure and polar alignment errors |

| | |
|----------------------------|--|
| Security stop | +/- 30° past meridian in r.a. (software) +/- 45° past meridian in r.a. (mechanical) |
| Communication ports | RS-232 port; GPS port; autoguide ST-4 protocol port; Ethernet port |
| Database | Stars: by name, Bayer designation, Flamsteed designation, Bright Star Catalogue, SAO, HIP, HD, PPM, ADS, GCVS. Deep-sky: M, NGC, IC, PGC, UGC limited up to $m_v = 16$. Solar system: Sun, Moon, planets, asteroids, comets, artificial satellites. Equatorial and altazimuth coordinates. User defined objects, fast slewing positions. |
| Firmware features | User defined mount parking position, 2-stars and 3-stars alignment function, up to 100 alignment stars for modeling, correction of polar alignment and orthogonality errors, estimate of average pointing error, storage of multiple pointing models, sidereal, solar and lunar tracking speed adjustable on both axes, declination-based autoguide speed correction, adjustable horizon height limit, pointing and tracking past meridian, assisted balance adjustment, manual or GPS based time and coordinates setting, automatic synchronization to PC clock with ClockSync proprietary software, leap second support and full accounting for the UT1 – UTC timescales, direct dome control via RS-232, configurable atmospheric refraction, network settings, comets and asteroids filter, multi-language interface. Remote Assist via Internet connection. |
| Keypad control | Rugged keypad with metal housing and reliable micro switches, large graphic display with up to five text lines and status icons, heating for low temperature operation, dimmable display and backlit keys; all the functionality of the mount is available through the keypad without requiring an external PC. |
| PC control | Remote control via RS-232 or Ethernet; proprietary ASCOM driver or LX200 compatible protocol; update of firmware and orbital elements of comets, asteroids and artificial satellites via RS-232 or Ethernet; virtual keypad control panel via RS-232 or Ethernet; integrated Wi-Fi module for connection with smartphones, tablets and any wireless network. |

ACCESSORIES FOR GM2000HPS

#10M2135

4" MAXI plate. To mount the MAXI dovetail bar (#10M2199). Dovetail with dual locking knobs and safety lock. Length 250 mm. Requires the #10M4545 adapter flange.



#10M2199

4" MAXI dovetail bar
Matches the MAXI plate (#10M2135).
Length 400 mm.



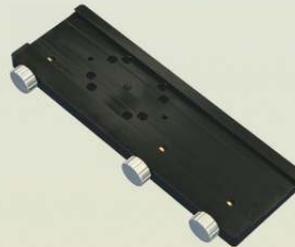
#10M2085

Losmandy 3" dovetail plate.
To mount the Losmandy universal dovetail bars #10M2125 / #10M2130, with dual locking knobs.



#10M2185

Losmandy 3" dovetail plate.
To mount the Losmandy universal dovetail bars #10M2125 / #10M2130, with three locking knobs (#10M2185).



#10M2125 – #10M2130

Losmandy dovetail bar.
Matches the Losmandy plates (#10M2085, #10M2185). Length 300 mm (#10M2125), 400 mm (#10M2130).



#10M2105

Lodual plate.

Support for two optics. Losmandy compatible, built from a 40 cm bar and two Losmandy plates, weight 4 kg – 9 lbs, center-to-center distance 27 cm.



#10M2100

Maxidual double dovetail plate.

Support for two optics. Built from a MAXI dovetail plate, a MAXI dovetail bar and two Losmandy dovetail plates.



#10M2075 - #10M2080

Counterweight

Weight: 6 kg – 13.2 lbs (#10M2075), 12 kg – 26.4 lbs (#10M2080).
Stainless steel.



#10M2057

Centaurus II tripod.

Anodized aluminum, with double beam leg system and leveling screws. Upholstered cordura transport bag included. Weight 21 kg – 46 lbs, payload 200 kg – 440 lbs, adjustable height from 90 cm to 135 cm.



#10M2090

Pier adapter.

For assembly on new or pre-existing column. Electroplated steel.



#10M2010

GM2000 standard pillar.

Double leveling plates, height 110 cm.
Custom height available on request.



#10M2011

Electronics box holder for column.

Adapter to mount the electronics box to the column for easier integration.



#10M2577

Car lighter plug switching converter.

Input 12 VDC output 24 VDC 5 A 120 W converter, for field use with 12 V battery.



#10M2060

Portable power supply.

Input 110-240 V AC , output 24 V 6 A.



#10M4206

Stabilized power supply.

Input 110 V AC, output 24 V DC 6/8A
200 W.



#10M4105

GPS receiver module.

Directly connected to the mount, provides the exact time and coordinates of the observation site.



#10M2065

Mount head protective cover.

Cordura cover with upper zip, can be placed on the mount even with payload attached.



#10M2062H

2 PLB-resin flight-case set for monolithic GM2000HPS.

Heavy duty, shock-proof resin, with handles and recessed locks, internal padding. Includes: mount flight-case, trolley style, dimensions 75 cm x 52cm x 36 cm; counterweight shaft and counterweights flight-case with internal padding and accessory tray, dimensions 36 cm x 48 cm x 22 cm.



#10M2063H

**3 PLB-resin flight-case set for
Ultraportable GM2000HPS.**

Heavy duty, shock-proof resin, with handles and recessed locks, internal padding.
Includes: two flight-cases for the r.a. and dec. assemblies with shaped reinforced foam, dimensions 55 cm x 46 cm x 26 cm each; counterweight shaft and counterweights flight-case with internal padding and accessory tray, dimensions 36 cm x 48 cm x 22 cm.



#10M2066

**Special Foam fitted transport cardboard
box.**

Preformed foam inner padding and sturdy cardboard box with handles. Dimensions 63 cm x 56 cm x 50 cm.



#10M5010

PERSEUS LEVEL III software.

By Filippo Riccio. Astronomy simulation software and mount control via PC.

