

POLARIS-K1-H - April 3, 2023

Item # POLARIS-K1-H was discontinued on April 3, 2023. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

POLARIS® SIDE OPTIC RETENTION MOUNTS FOR Ø1" OPTICS

- ☐ **Designed for Long-Term Stability**
- ☐ **Matched Actuator and Back Plate Threading Minimize Drift and Backlash**
- ☐ **Minimal Temperature-Dependent Hysteresis**
- ☐ **Sapphire Adjuster Seats Prevent Wear Over Time**

POLARIS-K1E
3 Removable
Knob Adjusters



POLARIS-K1S4
2 Adjusters
with Side Holes



POLARIS-K1VS2
2 Adjusters
Vertical Drives



POLARIS-K1E3
3 Adjusters
Low-Profile



[Hide Overview](#)

OVERVIEW

Features

- Machined from Heat-Treated Stainless Steel with Low Coefficient of Thermal Expansion (CTE)
- Hardened Stainless Steel Ball Contacts with Sapphire Seats for Durability and Smooth Movement
- Matched Actuator and Back Plate Provide Stability and Smooth Kinematic Adjustment
 - POLARIS-K1 and POLARIS-K1-H Have Bronze Bushing Inserts
- Extensive Testing Guarantees Less than 2 µrad Deviation after 12.5 °C Temperature Cycling (See *Test Data* Tab for Details)
- Passivated Stainless Steel Surface Ideal for Vacuum and High-Power Laser Cavity Applications (Excluding POLARIS-K1 and POLARIS-K1-H)
- Patented Optic Bore Design with Monolithic Flexure Arm (US Patent 10,101,559, Excludes POLARIS-K1, POLARIS-K1-H, and POLARIS-K1-2AH)
- Custom Mount Configurations are Available by Contacting Tech Support

Polaris® Low-Drift Kinematic Mirror Mounts are the ultimate solution for applications requiring stringent long-term alignment stability.

Optic Retention

The Ø1" mirror mounts offered below feature either a patented Ø1" optic bore design with a monolithic flexure arm or a

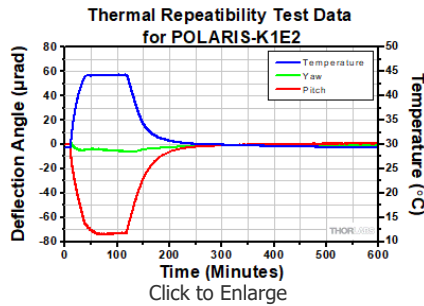
Polaris® Side Optic Retention Mounts Selection Guide

Ø1/2" Optic Mounts
Ø19 mm Optic Mount
Ø25 mm Optic Mount
Ø1" Optic Mounts
Ø1.5" Optic Mount
Ø50 mm Optic Mount
Ø2" Optic Mounts
Ø3" Optic Mounts

Ø1" Side Optic Retention Mounts Quick Links

3-Adjuster Mounts
Monolithic Optic Retention
Flexure Spring Optic Retention
Monolithic Optic Retention, Side Adjuster Holes
2-Adjuster Mounts
Monolithic Optic Retention, Low-Profile Hex Adjusters
Flexure Spring Optic Retention
Monolithic Optic Retention, Side Adjuster Holes
Monolithic Optic Retention, Vertical Drive
Accessories
Adjuster Knobs
Side Hole Adjustment Tool
Lock Nut
Locking Collar

flexure spring and setscrew design to secure the optic. Both of these designs provide high holding force and pointing stability with minimal optic distortion. For more details, please see the *Test Data* tab.



Polaris optic bores are precision machined to achieve a fit that will provide optimum beam pointing stability over changing environmental conditions such as temperature changes, transportation shock, and vibration. Performance will be diminished if a Ø1" mount is used with a Ø25 mm optic or an optic with an outer diameter tolerance greater than zero. See our Ø25 mm Polaris mount if you require a mount that is compatible with Ø25 mm optics.

Design

Machined from heat-treated stainless steel, Polaris mounts utilize precision-matched adjusters with ball contacts and sapphire seats to provide smooth kinematic adjustment. As shown on the *Test Data* tab, these mounts have undergone extensive testing to ensure high-quality performance. The Polaris design addresses all of the common causes of beam misalignment; please refer to the *Design Features* tab for detailed information.

Each Polaris mount undergoes extensive thermal testing to ensure high-quality performance. Please see the *Test Data* tab for additional test results.

Post Mounting

The Polaris mirror mounts are equipped with #8 (M4) counterbores for post mounting. Select mounts also include Ø2 mm alignment pin holes around the mounting counterbore, allowing for precision alignments when paired with our posts for Polaris mirror mounts. See the *Usage Tips* tab for more recommendations about mounting configurations.

Cleanroom and Vacuum Compatibility

All of our Polaris mounts, excluding the POLARIS-K1 and POLARIS-K1-H flexure spring mounts, are designed to be compatible with cleanroom and vacuum applications. See the *Specs* tab and the *Design Features* tab for details. The POLARIS-K1E and the POLARIS-K1E3 monolithic retention mounts are vacuum-compatible alternatives to the POLARIS-K1 and POLARIS-K1-H mounts, respectively.

[Hide Specs](#)

S P E C S

Polaris Mirror Mounts with Monolithic Flexure Arm

Item # Suffix ^a	-K1E	-K1E3	-K1S5	-K1E2	-K1S4	-K1VS2	-K1VS2L
Optic Size ^b	Ø1"						
Optic Thickness (Min)	0.14" (3.5 mm)						
Number of Adjusters	Three	Three	Three	Two	Two	Two	Two
Adjuster Drive	Removable Knobs	5/64" Hex, Low Profile	5/64" Hex, Ø0.07" Side Adjustment Holes	5/64" Hex, Low Profile	5/64" Hex, Ø0.07" Side Adjustment Holes	5/64" Hex, Vertical Drive, Right Handed	5/64" Hex, Vertical Drive, Left Handed
Adjuster Pitch	100 TPI						
Actuator Matching	Matched Actuator/Body Pairs						
Measured Point-to-Point Mechanical Resolution per Adjuster (Bidirectional Repeatability)	5 µrad (Typical); 2 µrad (Achievable)						
Adjustment per Revolution ^c	~7.7 mrad/rev						
Front Plate Translation (Max)	6 mm			N/A			
Mechanical Angular Range (Nominal)	±4°						
Front Plate Separation at Pivot Adjuster	3.175 mm (Nominal)						
Beam Deviation ^d After Thermal Cycling	<1 µrad						
Recommended Optic Mounting Torque ^e	5 - 7 oz-in for 6 mm Thick UVFS Optics						
Mounting	Two #8 (M4) Counterbores at 90°					One #8 (M4) Counterbore	
Alignment Pin Holes	None	Two at Each Counterbore ^f	None	None	None	Two at Each Counterbore ^f	None
Vacuum Compatibility ^g	10 ⁻⁹ Torr at 25 °C with Proper Bake Out 10 ⁻⁵ Torr at 25 °C without Bake Out						

	Grease Vapor Pressure: 10 ⁻¹³ Torr at 20 °C; 10 ⁻⁵ Torr at 200 °C Epoxy Meets Low Outgassing Standards NASA ASTM E595, Telcordia GR-1221
Operating Temperature Range	-30 to 200 °C

- a. All item numbers in the Polaris line start with POLARIS. Click on the item number suffix to jump to the mount's location on the page.
- b. For best performance, use optics with a diameter tolerance of up to +0/-0.1 mm.
- c. When the Front Plate is Parallel to the Back Plate
- d. After 12.5 °C temperature cycle, the beam returns to less than 1 μrad of its original position for a Polaris mounted at a 2" beam height using a stainless steel Ø1" post and POLARIS-CA1 clamping fork. Please see the *Test Data* tab for more details.
- e. The optimal optic mounting torque can vary by ±1 oz-in due to variations in optic diameter and tolerance buildup.
- f. Standard DIN 7-m6 ground dowel pins are recommended. The recommended tolerance for the location of the mating dowel pin holes and threaded mounting hole is ±0.003".

- g. Vacuum-compatible Polaris mounts are assembled in a clean environment, chemically cleaned using the Carpenter AAA passivation method to remove sulfur, iron, and contaminants from the surface, and double vacuum bagged. The 8-32 and M4 cap screws included with the Polaris mounts are not rated for pressures below 10⁻⁵ Torr. Prior to placing any components in a sensitive vacuum system, a thorough pre-baking in a bake-out oven should be performed to remove all moisture and surface volatiles. Contact Tech Support for details.

Polaris Mirror Mounts with Flexure Spring

Item # Suffix ^a	-K1	-K1-H	-K1-2AH
Optic Size^b	Ø1"		
Optic Thickness (Min)	0.08" (2 mm)		
Number of Adjusters	Three		Two
Adjuster Drive	Removable Knobs	5/64" Hex, Low Profile	5/64" Hex, Low-Profile
Adjuster Pitch	100 TPI		
Actuator Matching	Matched Actuator/Bushing Pairs		Matched Actuator/Body Pairs
Measured Point-to-Point Mechanical Resolution per Adjuster (Bidirectional Repeatability)	5 μrad (Typical); 2 μrad (Achievable)		
Adjustment per Revolution^c	~7 mrad/rev		
Front Plate Translation (Max)	6 mm		N/A
Mechanical Angular Range (Nominal)	±4°		
Front Plate Separation at Pivot Adjuster	3.175 mm (Nominal)		3.175 mm
Beam Deviation^d After Thermal Cycling	<2 μrad		
Recommended Optic Mounting Torque^e	6 - 10 oz-in for 6 mm Thick UVFS Optics		
Mounting	Two #8 (M4) Counterbores		
Alignment Pin Holes	None		
Vacuum Compatibility^f	No ^g		10 ⁻⁹ Torr at 25 °C with Proper Bake Out 10 ⁻⁵ Torr at 25 °C without Bake Out Grease Vapor Pressure: 10 ⁻¹³ Torr at 20 °C; 10 ⁻⁵ Torr at 200 °C Epoxy Meets Low Outgassing Standards NASA ASTM E595, Telcordia GR-1221
Operating Temperature Range	-30 to 200 °C		

- a. All item numbers in the Polaris line start with POLARIS. Click on the item number suffix to jump to the mount's location on the page.
- b. For best performance, use optics with a diameter tolerance of up to +0/-0.1 mm.
- c. When the Front Plate is Parallel to the Back Plate
- d. After 12.5 °C temperature cycle, the beam returns to within 2 μrad of its original position for a Polaris mounted on a Ø1" post with a 2" beam height. Please see the *Test Data* tab for more details.
- e. The optimal optic mounting torque can vary by ±1 oz-in due to variations in optic diameter and tolerance buildup.
- f. Vacuum-compatible Polaris mounts are assembled in a clean environment, chemically cleaned using the Carpenter AAA passivation method to remove sulfur, iron, and contaminants from the surface, and double vacuum bagged. The 8-32 and M4 cap screws included with the Polaris mounts are not rated for pressures below 10⁻⁵ Torr. Prior to placing any components in a sensitive vacuum system, a thorough pre-baking in a bake-out oven should be performed to remove all moisture and surface volatiles. Contact Tech Support for details.
- g. While these mounts use the same grease and epoxy as our other Polaris mounts, they include components unsuitable for use in vacuum environments. The POLARIS-K1E and POLARIS-K1E3 mounts sold below are vacuum-compatible alternatives to the POLARIS-K1 and POLARIS-K1-H Ø1" mounts, respectively.

TEST DATA

Polaris® Mirror Mounts Test Data

All of the Polaris Low-Drift Kinematic Mirror Mounts have undergone extensive testing to ensure high-quality performance. Thermal Shock testing confirms the exceptional stability of the mounts and demonstrates that they reliably return to their initial position after a transient temperature shift. Interferometric wavefront distortion testing demonstrates the ability of Polaris mounts to secure an optic without significantly distorting the optical surface.

Vibration Testing

Purpose: This testing was done to determine how reliably Polaris mirror mounts behave when subjected to intense physical vibrations.

Procedure: A pair of identical POLARIS-K1S4 mirror mounts were mounted on Ø1" Posts for Polaris Mirror Mounts and secured to a stainless steel breadboard with POLARIS-CA1 clamping arms. Laser beams were reflected from the mirrors onto two position sensing detectors, located on the same breadboard. The entire platform was vibrated with a variable frequency and amplitude and the displacement of the beam on the detector was recorded. The two beam paths were oriented at right angles so that the vibrational motion was in a direction parallel to the face of one mount and perpendicular to the face of the other. Please see the video to the right for a demonstration of our Polaris vibration test (the mount shown in the video is the POLARIS-K19S4 Ø19 mm mount).

Results: When subjected to vibrational frequencies as high as 100 Hz and accelerations as high as 6 g, the POLARIS-K1S4 mounts remained mechanically sound. The angular position of the mounts remained stable within about 10 µrad for both parallel and perpendicular vibrations.

Conclusions: Our POLARIS-K1S4 Ø1" Polaris mirror mounts provide exceptional performance, even under rugged operating conditions. As a result, these mounts are ideal for use in systems that require the greatest degree of stability when vibrational noise is expected.

Positional Repeatability After Thermal Shock

Purpose: This testing was done to determine how reliably the mount returns the mirror, without hysteresis, to its initial position. These measurements show that the alignment of the optical system is unaffected by the temperature shock.

Procedure: After mounting the Polaris to a Ø1" Post, the mirror and post assembly was secured to a stainless steel optical table in a temperature-controlled environment. The mirror was held using the flexure mechanism; see the *Usage Tips* tab for additional mounting recommendations. A beam from an independently temperature-stabilized laser diode was reflected by the mirror onto a position sensing detector. The temperature of each mirror mount tested was raised to at least 37 °C. The elevated temperature was maintained in order to soak the mount at a constant temperature. Then the temperature of the mirror mount was returned to the starting temperature. The results of these tests are shown below.

Results: As can be seen in the plots below, when the Polaris mounts were returned to their initial temperature, the angular position (both pitch and yaw) of the mirrors returned to within 1 µrad of its initial position. The best result achieved with a competitor's mount was significantly worse than the Polaris mounts. The performance of the Polaris was tested further by subjecting the mount to repeated temperature change cycles. After each cycle, the mirror's position reliably returned to within 1 µrad of its initial position.

For Comparison: To get a 1 µrad change in the mount's position, the 100 TPI adjuster on the POLARIS-K1 Ø1" Polaris mount needs to be rotated by only 0.05° (1/7200 of a turn). A highly skilled operator might be able to make an adjustment as small as 0.3° (1/1200 of a turn), which corresponds to 6 µrad.

Conclusions: The Polaris Mirror Mounts are high-quality, ultra-stable mounts that will reliably return a mirror to its original position after cycling through a temperature change. As a result, the Polaris mounts are ideal for use in applications that require long-term alignment stability.

POLARIS-K1 and POLARIS-K1-H 3-Adjuster Mounts, Flexure Spring Optic Retention

POLARIS-K1S5 3-Adjuster Mount with Adjuster Side Holes, Monolithic Optic Retention

POLARIS-K1E2 2-Adjuster Mount, Monolithic Optic Retention

POLARIS-K1-2AH 2-Adjuster Mount, Flexure Spring Optic Retention

POLARIS-K1S4 2-Adjuster Mount with Adjuster Side Holes, Monolithic Optic Retention

POLARIS-K1VS2 and POLARIS-K1VS2L 2-Adjuster Mounts with Vertical Drive, Monolithic Optic Retention

Optical Distortion Testing Using a ZYGO Phase-Shifting Interferometer

Mounting stresses are responsible for the strain that results in optical surface distortion. Minimizing distortion effects is crucial; any distortion to the optic affects the reflected wavefront. Many of the Ø1" Polaris mounts sold below feature a monolithic flexure arm that is designed to provide maximum stability while minimizing optic distortion.

To determine the amount of optic distortion exerted on the mirror by the flexure arm, a ZYGO Phase-Shifting Interferometer was used to measure the wavefront distortion at different torque values (see screenshots of the Zygo testing runs by clicking on the links in the table below to the right). Based on results of the tests, we recommend a torque of 5 - 7 oz-in for our Ø1" Polaris mounts, at which the optic wavefront distortion is $\leq 0.1\lambda$.

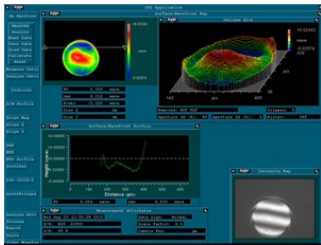
Please note that the optimal optic mounting torque can vary by ± 1 oz-in due to variations in optic diameter and tolerance buildup.

Procedure:

A broadband dielectric mirror was installed into a Polaris mount using the setscrew to clamp down the flexure arm. Measurements of the optic distortion were then recorded using the ZYGO interferometer. Once each measurement was complete, the amount of force needed to push the optic out of the mount was measured to check optic retention. The wavefront distortion values shown in the top left PV field give peak-to-valley distortion across the entire optic, representing the worst-case scenario; the center of the optic exhibits significantly less distortion than the edge.

Results:

As seen in the table below, the peak-to-valley wavefront distortion was found to be $\leq 0.1\lambda$ when 5 - 7 oz-in of torque was applied to the setscrew of the POLARIS-K1S4 Ø1" mount.



Click to Enlarge
POLARIS-K1S4 Wavefront Distortion for
Setscrew Torque of 7 oz-in (See Table to the
Right for Other Setscrew Torques)

Wavefront Distortion for a Ø1" Mirror in a POLARIS-K1S4 Mount		
Torque (oz-in) ^a	Wavefront Distortion (Peak to Valley) ^b (Click for Example Zygo Screenshot)	Push-Out Force (lbf) ^c
4.5	0.072 λ to 0.093 λ	>12
5	0.047 λ to 0.090 λ	
5.5	0.057 λ to 0.097 λ	
6	0.085 λ to 0.100 λ	
6.5	0.057 λ to 0.073 λ	
7	0.059 λ to 0.067 λ	
7.5	0.083 λ to 0.092 λ	
8	0.128 λ to 0.145 λ	
8.5	0.102 λ to 0.117 λ	
9	0.141 λ to 0.162 λ	
10	0.188 λ to 0.224 λ	

- a. The recommended optic mounting torque range is indicated by the green highlighted rows.
- b. Wavefront distortion measurements were performed at $\lambda = 633$ nm. The Zygo interferometer aperture outer diameter was set to 80% for these measurements. These values represent the minimum and maximum values over multiple independent tests.
- c. Push-out force is the force required to move the mounted optic at the given torque value.

Hide Design Features

DESIGN FEATURES



Click to Enlarge
Details of the POLARIS-K1S4 Design. Note that some mounts on this page use a flexure spring to retain the optic and have bronze bushings instead of matched actuator/body pairs.

Several common factors typically lead to beam misalignment in an optical setup. These include temperature-induced hysteresis of the mirror's position, crosstalk, drift, and backlash. Polaris mirror mounts are designed specifically to minimize these misalignment factors and thus provide extremely stable performance. Hours of extensive research, multiple design efforts using sophisticated design tools, and months of rigorous testing went into choosing the best components to provide an ideal solution for experiments requiring ultra-stable performance from a kinematic mirror mount.

Thermal Hysteresis

The temperature in most labs is not constant due to factors such as air conditioning, the number of people in the room, and the operating states of equipment. Thus, it is necessary that all mounts used in an alignment-sensitive optical setup be designed to minimize any thermally induced alignment effects. Thermal effects can be minimized by choosing materials with a low coefficient of thermal expansion

(CTE), like stainless steel. However, even mounts made from a material with a low CTE do not typically return the mirror to its initial position when the initial temperature is restored. All the critical components of the Polaris mirror mounts are heat treated prior to assembly since this process removes internal stresses that can cause a temperature-dependent hysteresis. As a result, the alignment of the optical system will be restored when the temperature of the mirror mount is returned to the initial temperature.

The method by which the mirror is secured in the mount is another important design factor for the Polaris; these Polaris mounts offer excellent performance without the use of adhesives. Instead, the majority of the mounts offered on this page use a monolithic flexure arm that is pressed onto the edge of the mirror using a setscrew. Setscrews, when used by themselves to hold an optic, tend to move as the temperature changes. In contrast, the holding force provided by the stainless steel flexure arm is sufficient to keep the mirror locked into place regardless of the ambient temperature. Alternatively, the POLARIS-K1, POLARIS-K1-H, and POLARIS-K1-2AH Ø1" mounts use a flexure spring to hold the edge of the optic. This also secures optics with reduced distortion compared a standard setscrew design, albeit with less retention force than the monolithic flexure arm.

Crosstalk

Crosstalk is minimized by carefully controlling the dimensional tolerances of the front and back plates of the mount so that the pitch and yaw actuators are orthogonal. In addition, sapphire seats are used at all three contact points. Standard metal-to-metal actuator contact points will wear down over time. The polished sapphire seats of the Polaris mounts, in conjunction with the hardened stainless steel actuator tips, maintain the integrity of the contact surfaces over time.

Drift and Backlash

In order to minimize the positional drift of the mirror mount and backlash, it is necessary to limit the amount of play in the adjuster as well as the amount of lubricant used. When an adjustment is made to the actuator, the lubricant will be squeezed out of some spaces and built up in others. This non-equilibrium distribution of lubricant will slowly relax back into an equilibrium state. However, in doing so, this may cause the position of the front plate of the mount to move. The Polaris mounts use adjusters matched to the body or bushings that exceed all industry standards so very little adjuster lubricant is needed. As a result, alignment of the Polaris mounts is extremely stable even after being adjusted (see the *Test Data* tab for more information). In addition, these adjusters have a smooth feel that allows the user to make small, repeatable adjustments.

Cleanroom and Vacuum Compatibility

With the exception of Item #s POLARIS-K1 and POLARIS-K1-H, all Polaris mounts sold on this page are designed to be compatible with cleanroom and vacuum applications. They are chemically cleaned using the Carpenter AAA passivation method to remove sulfur, iron, and contaminants from the surface. After passivation, they are assembled in a clean environment and then double vacuum bagged to eliminate contamination when transported into a cleanroom.

The sapphire contacts are bonded into place using a NASA-approved low outgassing procedure. In addition, DuPont LVP High-Vacuum (Krytox) Grease, an ultra-high vacuum compatible, low outgassing PTFE grease, is applied to the adjusters. These features provide high vacuum compatibility and low outgassing performance. When operating at pressures below 10^{-5} Torr, we highly recommend using an appropriate bake out procedure prior to installing the mount in order to minimize contamination caused by outgassing. Please note that the 8-32 and M4 cap screws included with the Polaris mounts are not rated for pressures below 10^{-5} Torr.



Click to Enlarge
All vacuum-compatible Polaris mounts are shipped inside two vacuum bag layers.

See the POLARIS-K1E and POLARIS-K1E3 mounts below for vacuum-compatible alternatives to the POLARIS-K1 and POLARIS-K1-H mounts, respectively.

Cleanroom-Compatible Packaging

Each vacuum-compatible Polaris mount is packaged within two vacuum bag layers after assembly in a clean environment, as seen in the image to the right. The vacuum-tight fit of the bags stabilizes the mount, limiting translation of the front plate due to shocks during transportation. The tight fit also minimizes rubbing against the bag, preventing the introduction of bag material shavings that would contaminate the clean mount.

In the vacuum-sealing process, moisture-containing air is drawn out of the packaging. This eliminates unwanted reactions on the surface of the mount without the need for desiccant materials. The vacuum bags protect the mount from contamination by air or dust during transport and storage, and the double-vacuum bag configuration allows for a straightforward and effective cleanroom entry procedure. The outer bag can be removed outside of the cleanroom, allowing the contaminant-free inner bag to be placed into a clean container and transferred into the cleanroom while retaining the benefits of vacuum-bag packaging. Inside the cleanroom, the mount can be removed from the inner bag when ready for use.

[Hide Usage Tips](#)

USAGE TIPS

Through thermal changes and vibrations, the Polaris® kinematic mirror mounts are designed to provide years of use. Below are some usage tips to ensure that the mount provides optimal performance.

Match Materials

Due to its relatively low coefficient of thermal expansion, stainless steel was chosen as the material from which to fabricate the front and back plates of the Polaris mounts. When mounting, we recommend using components fabricated from the same material, such as our Ø1" Posts for Polaris Mirror Mounts and Polaris Clamping Arm.

Use a Wide Post

The Polaris' performance is optimized for use with our Ø1" Posts and our Polaris Clamping Arm. These posts are made of stainless steel and provide two lines of contact with the mount, which help confine the bottom of the mount during variations in the surrounding temperature, thereby minimizing potential alignment issues.

Optic Mounting

Since an optic is prone to movement within its mounting bore, all optics should be mounted with the Polaris out of the setup to ensure accurate mounting that will minimize misalignment effects. We recommend using a torque wrench when installing an optic in the Polaris mounts. Over torquing the monolithic flexure arm optic retainer past the recommended 5 - 7 oz-in range can result in a significant increase in the surface distortion of mounted optics (see the graph to the right).

Front Plate's Position

Ø1" Polaris mounts are designed to allow adjustments of up to 8°. To achieve the best performance, it is recommended that the front plate be kept as parallel as possible to the back plate. This ensures the highest stability of the adjustments.

Mount as Close to the Table's Surface as Possible

To minimize the impact of vibrations and temperature changes, it is recommended that your setup has as low of a profile as possible. Using short posts will reduce the Y-axis translation caused by temperature variations and will minimize any movements caused by vibrations. Mount the Polaris directly onto a flat surface such as a breadboard using a 1/4"-20 to 8-32 thread adapter (Item #AE8E25E) or M6 x 1.0 to M4 x 0.7 adapter (Item #AE4M6M). For direct mounting, the POLARIS-K1E and POLARIS-K1 mounts must have the bottom two knobs removed, as shown in the photo to the right. By doing so, the instability introduced by a post will be eliminated.

Polish and Clean the Points of Contact

We highly recommend that the points of contact between the mount and the post, as well as the post and the table, are clean and free of scratches or defects. For best results, we recommend using a polishing stone to clean the table's surface and an LFG1P polishing pad for the top and bottom of the post as well as the bottom of the mount.

Use Polaris-Specific Adjustment Tools

The SA1 Adjustment Tool features a precision fit tip on that is designed for the 0.07" side-hole adjusters of the POLARIS-K1S4 and POLARIS-K1S5 Ø1" mounts. Additionally, its handle includes a 5/64" (2.0 mm) hex which is compatible with the adjuster screws of all Polaris mounts sold below. We also offer the POLARIS-N5 stainless steel knobs, which can be used to adjust 1/4"-100 adjuster screws on the side-hole adjuster mounts and the vertical-drive mounts by hand; however, the mechanical angular range may be reduced when these knobs are used with vertical-drive mounts as the knobs screw directly onto the exposed adjuster threads. For Ø1" Polaris mounts which are exposed to shock and vibration, excluding those with low-profile adjusters, Thorlabs offers the POLARIS-LN1 1/4"-100 Lock Nut. In situations where frequent adjustment is the required, the POLARIS-LN1 lock nut can be hand-tightened with a torque of 4 to 8 oz-in (0.03 to 0.06 N*m). If long-term stability is required, the TW13 Torque Wrench can be used to tighten the lock nuts with 32 oz-in of torque. The POLARIS-LNS1 Locking Collar offers similar features to the POLARIS-LN1 lock nut, while also being compatible with the POLARIS-T2 spanner wrench, and is ideal for use with our Polaris Ø1" Mounts with Vertical Drives.

Not Recommended

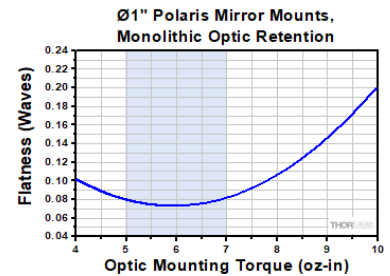
We do not recommend taking the adjusters out of the back plate, as it can contaminate the threading. This can reduce the fine adjustment performance significantly. Also, do not pull the front plate away as it might stretch the springs beyond their operating range or crack the sapphire seats. Finally, do not over tighten the retaining screws that secure the flat spring that holds the optic in place; only slight force is required to secure the optic in place.



Click to Enlarge
A POLARIS-K05 mount can be mounted to a surface using a Ø1" Post for Polaris Mirror Mounts and a Polaris Clamping Arm. Using a 1.5" long post, the optical axis is 2" above the table surface.







Click to Enlarge
POLARIS-K1E Mounted Directly to Breadboard using an AE8E25E 1/4"-20 to 8-32 Adapter







Click to Enlarge
The shaded 5 - 7 oz-in region in this plot denotes the recommended optic mounting torque for a 6 mm thick optic in Ø1" Polaris mounts with monolithic optic retention. Over torquing the monolithic flexure arm past the recommended 5 - 7 oz-in range can result in a significant increase in the surface distortion of mounted optics. Click here for a similar graph showing optic distortion for a mirror mounted in a mount that uses the flexure spring retention mechanism.



Thorlabs offers several different general varieties of Polaris mounts, including kinematic side optic retention, SM-threaded, low optic distortion, piezo-actuated, vertical drive, and glue-in optic mounts, a fixed monolithic mirror mount and fixed optic mounts, an XY translation mount, 5-axis kinematic mount, and a kinematic platform mount. Refer to the tables below for our complete line of Polaris mounts, grouped by mount type, optic bore size, and then arranged by optic retention method and adjuster type (or intended application in the case of fixed mounts). We also offer a line of accessories that have been specifically designed for use with our Polaris mounts; these are listed in the table to the lower right. Note that the tables below list Item # suffixes that omit the "POLARIS" prefix for brevity. Click the photos below for details.





If your application requires an optic mount design that is not available below, please contact Tech Support.


Polaris Mount Optic Retention Methods			
Side Lock	SM Threaded	Low Distortion	Glue-In
			

Polaris Mount Adjuster Types					
Side Hole	Hex	Adjuster Knobs	Adjuster Lock Nuts	Piezo Adjusters	Vertical-Drive Adjusters
					

Polaris Kinematic Mounts for Round Optics				
Optic Retention Method	Side Lock	SM Threaded	Low Distortion	Glue-In
Ø1/2" Optics				
2 Side Hole Adjusters	-	-	-	- K05C4 - K05G4
2 Hex Adjusters	-K05S1	-K05T1	-K05F1	-
2 Adjusters with Lock Nuts	-K05S2	-K05T2	-K05F2	-
2 Piezoelectric Adjusters	-K05P2	-	-	-
3 Hex Adjusters	-K05	-	-	-
3 Adjusters with Lock Nuts	-	-K05T6	-K05F6	-
Ø19 mm (3/4") Optics				
2 Side Hole Adjusters	-K19S4	-	-K19F4/M	- K19G4
Ø25 mm Optics				
2 Side Hole Adjusters	- K25S4/M	-	-K25F4/M	-
Ø1" Optics				
2 Side Hole Adjusters	-K1S4	-	-	-K1C4 -K1G4
2 Hex Adjusters	-K1E2 -K1-2AH	-K1T2	-K1F2	-
2 Adjuster Knobs	-	-K1T1	-K1F1	-
2 Piezoelectric Adjusters	-K1S2P	-	-	-
2 Vertical Adjusters	-K1VS2 -K1VS2L	-	-	-
3 Side Hole Adjuster	-K1S5	-	-	-
3 Hex Adjusters	-K1E3 -K1-H	-K1T3	-	-
3 Adjuster Knobs	-K1E -K1	-K1T	-K1F	-
3 Piezoelectric Adjusters	-K1S3P	-	-	-
3 Adjuster Knobs (Tip/Tilt/Z) & 2 Hex Adjusters (X/Y)	-	-K1XY	-	-
Optic Retention Method	Side Lock	SM Threaded	Low Distortion	Glue-In
Ø1.5" Optics				

Polaris XY Translation Mounts for Round Optics		
Optic Retention Method	SM Threaded	Representative Photos
Ø1" Optics		
2 Hex Adjusters (X/Y)	-1XY	
3 Adjuster Knobs (Tip/Tilt/Z) & 2 Hex Adjusters (X/Y)	-K1XY	
Ø1.5" Optics		
2 Hex Adjusters (X/Y) & 3 Adjuster Knobs (Tip/Tilt/Z)	-K15XY	

Polaris Fixed Mounts for Round Optics				
Optic Retention Method	Side Lock	Glue-In	Representative Photos	
Ø1/2" Optics				
Optimized for Mirrors	-	-C05G		
Optimized for Beamsplitters	-B05S	-B05G		
Optimized for Lenses	-	-L05G		
Ø19 mm (3/4") Optics				
Optimized for Mirrors	-19S50/M	-		
Ø1" Optics				
Optimized for Mirrors	-	-C1G		
Optimized for Beamsplitters	-B1S	-B1G		
Optimized for Lenses	-	-L1G		
Ø2" Optics				
Optimized for Mirrors	-	-C2G		
Optimized for Beamsplitters	-B2S	-		

Polaris Kinematic 1.8" x 1.8" Platform Mount		
Optomech Retention Method	Tapped Holes & Counterbores	
2 Adjuster Knobs	-K1M4/(M)	

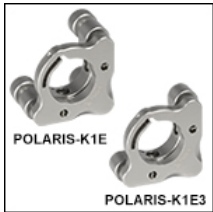
Accessories for Polaris Mounts

2 Side Hole Adjusters	-K15S4	-	-K15F4	-
2 Vertical Adjusters	-K15VS2 - K15VS2L	-	-	-
3 Adjuster Knobs (Tip/Tilt/Z) & 2 Hex Adjusters (X/Y)	-	-K15XY	-	-
Ø50 mm Optics				
2 Side Hole Adjusters	- K50S4/M	-	-K50F4/M	-
Ø2" Optics				
2 Hex Adjusters	-K2S2	-K2T2	-K2F2	-
2 Adjuster Knobs	-K2S1	-K2T1	-K2F1	-
2 Piezoelectric Adjusters	-K2S2P	-	-	-
2 Vertical Adjusters	-K2VS2 -K2VS2L	-	-	-
3 Hex Adjusters	-K2S3	-K2T3	-K2F3	-
3 Adjuster Knobs	-K2	-K2T	-K2F	-
Ø3" Optics				
2 Side Hole Adjusters	-K3S4	-	-	-
3 Side Hole Adjusters	-K3S5	-	-	-
Ø4" Optics				
2 Side Hole Adjusters	-	-	-K4F4	-
Ø6" Optics				
2 Side Hole Adjusters	-	-	-K6F4	-

Description	Representative Photos
Ø1" Posts for Polaris Mounts	
Polaris Non-Bridging Clamping Arms	
Polaris 45° Mounting Adapter	

[Hide Polaris® Ø1" Kinematic Mirror Mounts, 3 Adjusters, Monolithic Optic Retention](#)

Polaris® Ø1" Kinematic Mirror Mounts, 3 Adjusters, Monolithic Optic Retention



- ▶ 3 Removable Knobs or 3 Hex-Driven Adjusters
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ ±4° Mechanical Angular Range (Nominal)
- ▶ ~7.7 mrad/rev Resolution
- ▶ Less than 1 µrad Deviation after Temperature Cycling
- ▶ Patented Monolithic Flexure Arm Design for Minimal Optic Distortion and Improved Optic Holding Stability (US Patent 10,101,559, See the *Test Data* Tab for Details)



Click to Enlarge
POLARIS-K1E Mount Features 3 Removable-Knob Adjusters and the POLARIS-K1E3 Features 3 Hex-Driven Adjusters

The POLARIS-K1E and POLARIS-K1E3 3-Adjuster Kinematic Ø1" Mirror Mounts provide tip and tilt adjustment, Z-axis (optical axis) adjustment, and serve as vacuum-compatible alternatives to the POLARIS-K1 and POLARIS-K1-H mounts, respectively. The Polaris integrated matched adjuster/body design results in greater durability and thermal performance compared to non-Polaris mirror mounts.

A monolithic flexure arm that can be tightened using a 0.05" (1.3 mm) hex key is used to secure an optic in these mounts. This optic retention mechanism keeps the wavefront distortion on the mounted optic to a minimum while providing an optic retention force that is much stronger than the force provided by our Ø1" Polaris mounts that use a setscrew and flexure spring design (see the *Test Data* tab for more information).

The POLARIS-K1E mount features removable knob adjusters; the knobs facilitate improved feel in fine-resolution adjustments, without blocking the adjuster hex. For added stability, the POLARIS-LN1 lock nuts or POLARIS-LNS1 locking collars, sold separately below, can be installed by removing the knobs. The POLARIS-K1E3 mount has low-profile 5/64" (2.0 mm) hex adjusters that are ideal for use in tight spaces, and can be actuated using our HKTS-5/64 Hex Key Thumbscrews (sold below), or any other 5/64" (2.0 mm) hex key. Note that, due to the low profile design, these adjusters are not compatible with lock nuts or locking collars.

Post mounting is provided by two #8 (M4) counterbores at 90°. We recommend using these mounts with a stainless steel post, such as our Ø1" Posts for Polaris Mirror Mounts. We also recommend using a torque driver to accurately install the optic and prevent optical surface distortion. Please see the *Usage Tips* tab for more information and other usage recommendations.

See the POLARIS-K1E2 mirror mount below for a 2-adjuster mount which offers similar features to the POLARIS-K1E3 mirror mount, but replaces the third adjuster with a hardened steel ball. This design offers improved stability, but removes the utility of Z-axis adjustment.

Part Number	Description	Price	Availability
POLARIS-K1E	Polaris® Ø1" Mirror Mount, 3 Adjusters, Monolithic Optic Retention	\$165.90	Today
POLARIS-K1E3	Polaris® Ø1" Mirror Mount, 3 Low-Profile Hex Adjusters, Monolithic Optic Retention	\$157.50	Today

[Hide Polaris® Ø1" Kinematic Mirror Mounts, 3 Adjusters, Flexure Spring Optic Retention](#)

Polaris® Ø1" Kinematic Mirror Mounts, 3 Adjusters, Flexure Spring Optic Retention



- ▶ 3 Adjuster Knobs or 3 Hex-Driven Adjusters
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Bushing Pairs
- ▶ ±4° Mechanical Angular Range
- ▶ ~7 mrad/rev Resolution
- ▶ Less than 2 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Flexure Spring and Setscrew Retain Optic with Low Distortion



Click for Details
The POLARIS-K1-H
Features Low-Profile
Hex Adjusters Instead
of Knobs

These Ø1" Standard Polaris Kinematic Mirror Mounts, designed to provide easy high-resolution adjustment and long-term alignment stability, feature three actuators for tip and tilt plus Z-axis (optical axis) adjustment. The flexure spring and setscrew that retain the optic can be adjusted using a 5/64" (2.0 mm) hex key.

The POLARIS-K1 mount features removable knob adjusters; for added stability, the POLARIS-LN1 lock nuts or POLARIS-LNS1 locking collars, sold separately below, can be installed by removing the knobs. The POLARIS-K1-H mount is equipped with low-profile hex adjusters ideal for use in tight spaces and therefore is not compatible with our lock nuts or locking collars. The adjusters on both mounts are compatible with 5/64" (2.0 mm) hex keys and may be adjusted with our HKTS-5/64 Hex Key Thumbscrews (sold below) or any other 5/64" (2.0 mm) hex wrench.

Post mounting is provided by two #8 (M4) counterbores. We recommend using this mount with a stainless steel post, such as our Ø1" Posts for Polaris Mirror Mounts. We also recommend using a torque driver to accurately install the optic and prevent optical surface distortion. Please see the *Usage Tips* tab for more information and other usage recommendations.



Please Note: On April 30, 2023, these mounts will no longer be available as part of our stocked catalog offering. Their monolithic optic retention counterparts (POLARIS-K1E and POLARIS-K1E3, sold directly above) will be their direct catalog replacements. Existing OEM customers can continue to purchase these items via special order by reaching out to

OEMSales@thorlabs.com.

Part Number	Description	Price	Availability
POLARIS-K1	Polaris® Ø1" Mirror Mount, 3 Adjusters, Flexure Spring Retention	\$166.74	Today
POLARIS-K1-H	Customer Inspired! Polaris® Ø1" Mirror Mount, 3 Low-Profile Hex Adjusters, Flexure Spring Retention	\$161.56	Lead Time

[Hide Polaris® Ø1" Kinematic Mirror Mount, 3 Adjusters with Side Holes, Monolithic Optic Retention](#)

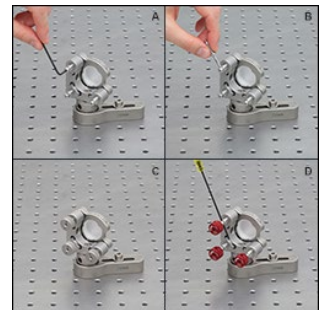
Polaris® Ø1" Kinematic Mirror Mount, 3 Adjusters with Side Holes, Monolithic Optic Retention



- ▶ 3 Hex Adjusters with Side Holes (See Image to the Right)
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ ±4° Mechanical Angular Range (Nominal)
- ▶ ~7.7 mrad/rev Resolution
- ▶ Less than 1 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Patented Monolithic Flexure Arm Design for Minimal Optic Distortion and Improved Optic Holding Stability (US Patent 10,101,559, See the *Test Data* Tab for Details)



Click to Enlarge
Mount Shown with
Optional POLARIS-N5
Removable Knobs



Click to Enlarge
Methods of Adjusting the POLARIS-K1S5 Ø1"
Mount:

A: 5/64" or 2.0 mm Hex Key in the End of the Adjuster

B: SA1 Tool Through Adjuster Side Holes

C: POLARIS-N5 Removable Knobs on the Adjuster

D: HKTS-5/64 Hex Knobs with Side Hole Fine

The POLARIS-K1S5 is the three-adjuster option of the POLARIS-K1S4 (sold below). This 3-adjuster Ø1" Polaris Kinematic Mirror Mount is designed to provide easy high-resolution adjustment and long-term alignment stability. The mount features a monolithic flexure arm that can be actuated using the included screw and a 0.05" (1.3 mm) hex key. The monolithic flexure arm design keeps wavefront distortion on the mounted optic to a minimum while providing an optic retention force that is much stronger than the force provided by our Ø1" Polaris mounts that use a setscrew and flexure spring design. See the *Test Data* tab for more information on the distortion of the optic caused by the

monolithic flexure arm. The three-adjuster design provides tip and tilt plus Z-axis (optical axis) adjustment. Compared to the POLARIS-K1, POLARIS-K1-H, POLARIS-K1E, and POLARIS-K1E3 Ø1" mounts, the stiffer springs used in the construction of the POLARIS-K1S5 mount provide enhanced stability, making this mount an ideal solution for OEM applications that require reliable operation in rugged environments.

The 100 TPI adjusters feature three Ø0.07" through holes that allow for actuation from the side using our precision-fit SA1 Side Hole Adjustment Tool (sold below) or a 1/16" (1.5 mm) balldriver or hex key. Each adjuster also has a 5/64" (2.0 mm) hex and may be adjusted with the hex on the end of the SA1, our HKTS-5/64 Hex Key Thumbscrews (sold below), or any other 5/64" (2.0 mm) hex wrench. Alternatively, POLARIS-N5 removable, low-profile adjustment knobs (sold below) can be threaded onto the adjusters for improved feel in fine-resolution adjustments; note that the removable knobs will block the adjuster side holes but not the hex. The adjusters on this mount can be locked using the POLARIS-LN1 lock nuts or POLARIS-LNS1 locking collars (sold separately below).

Post mounting is provided by two #8 (M4) counterbores at 90°. For custom mounting configurations, two Ø2 mm alignment pin holes are located on each mounting face for setting a precise location and mounting angle. Standard DIN 7-m6 ground dowel pins are recommended (click on the red documents icon below for details). We recommend using this mount with a stainless steel post that also has Ø2 mm alignment pin holes, such as our Ø1" Posts for Polaris Mirror Mounts.

Part Number	Description	Price	Availability
POLARIS-K1S5	Polaris® Ø1" Mirror Mount, 3 Hex Adjusters with Side Holes, Monolithic Optic Retention	\$220.73	Today

[Hide Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters, Monolithic Optic Retention](#)

Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters, Monolithic Optic Retention



- ▶ 2 Hex-Driven Adjusters
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ ±4° Mechanical Angular Range (Nominal)
- ▶ ~7.7 mrad/rev Resolution
- ▶ Less than 1 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Patented Monolithic Flexure Arm Design for Minimal Optic Distortion and Improved Optic Holding Stability (US Patent 10,101,559, See the *Test Data* Tab for Details)

The POLARIS-K1E2 2-Adjuster Ø1" Mirror Mount is similar to the POLARIS-K1E3 hex-driven 3-adjuster mount sold above, but features a hardened steel ball in place of the third adjuster. This improves mount stability by limiting the available degrees of freedom for movement, and the Polaris integrated matched adjuster/body design results in greater durability and thermal performance compared to non-Polaris mirror mounts.

A monolithic flexure arm that can be tightened using a 0.05" (1.3 mm) hex key is used to secure an optic in the mount. This optic retention mechanism keeps the wavefront distortion on the mounted optic to a minimum while providing an optic retention force that is much stronger than the force provided by our Ø1" Polaris mounts that use a setscrew and flexure spring design (see the *Test Data* tab for more information).

The mount's low-profile, 5/64" (2.0 mm) hex adjusters are ideal for use in tight spaces and can be actuated with our HKTS-5/64 Hex Key Thumbscrew (sold below) or any other 5/64" (2.0 mm) hex key. Note that, due to the low profile design, these adjusters are not compatible with lock nuts or locking collars.

Post mounting is provided by two #8 (M4) counterbores at 90°. We recommend using this mount with a stainless steel post, such as our Ø1" Posts for Polaris Mirror Mounts. We also recommend using a torque driver to accurately install the optic and prevent optical surface distortion. Please see the *Usage Tips* tab for more information and other usage recommendations.

Part Number	Description	Price	Availability
POLARIS-K1E2	Polaris® Ø1" Mirror Mount, 2 Low-Profile Hex Adjusters, Monolithic Optic Retention	\$152.25	Today

[Hide Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters, Flexure Spring Optic Retention](#)

Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters, Flexure Spring Optic Retention



- ▶ 2 Hex-Driven Adjusters
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ ±4° Mechanical Angular Range
- ▶ ~7 mrad/rev Resolution
- ▶ Less than 2 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Flexure Spring and Setscrew Retain Optic with Low Distortion



Click for Details
POLARIS-K1-2AH
Features an Integrated

Tapped Steel Body
Design for Durability
and Stability

This 2-Adjuster Ø1" Standard Polaris Kinematic Mirror Mount is similar to the standard hex-driven 3-adjuster version sold above but features a hardened steel ball in place of the third adjuster. The Polaris integrated matched adjuster/body design results in greater durability and thermal performance compared to non-Polaris mirror mounts, and the 2-adjuster design improves mount stability by limiting the available degrees of freedom for movement. The flexure spring and setscrew that retain the optic can be adjusted using a 0.05" (1.3 mm) hex key.

The mount's low-profile, 5/64" (2.0 mm) hex adjusters are ideal for use in tight spaces and can be actuated with our HKTS-5/64 Hex Key Thumbscrew (sold below) or any other 5/64" (2.0 mm) hex key. Note that, due to the low profile design, these adjusters are not compatible with lock nuts or locking collars.

Post mounting is provided by two #8 (M4) counterbores. We recommend using this mount with a stainless steel post, such as our Ø1" Posts for Polaris Mirror Mounts. We also recommend using a torque driver to accurately install the optic and prevent optical surface distortion. Please see the *Usage Tips* tab for more information and other usage recommendations.



Please Note: On April 30, 2023, this mount will no longer be available as part of our stocked catalog offering. Its monolithic optic retention counterpart (POLARIS-K1E2, sold directly above) will be its direct catalog replacement. Existing OEM customers can continue to purchase these items via special order by reaching out to OEMSales@thorlabs.com.

Part Number	Description	Price	Availability
POLARIS-K1-2AH	Customer Inspired! Polaris® Ø1" Mirror Mount, 2 Low-Profile Hex Adjusters, Flexure Spring Retention	\$153.25	Lead Time

[Hide Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters with Side Holes, Monolithic Optic Retention](#)

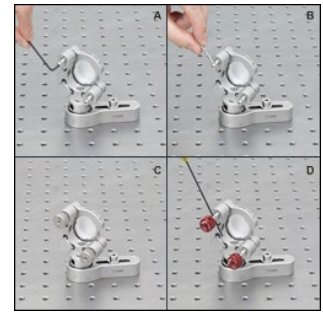
Polaris® Ø1" Kinematic Mirror Mount, 2 Adjusters with Side Holes, Monolithic Optic Retention



- ▶ 2 Hex Adjusters with Side Holes (See Image to the Right)
- ▶ Designed for use with Ø1" Optics
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ ±4° Mechanical Angular Range (Nominal)
- ▶ ~7.7 mrad/rev Resolution
- ▶ Less than 1 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Patented Monolithic Flexure Arm Design for Minimal Optic Distortion and Improved Optic Holding Stability (US Patent 10,101,559, See the *Test Data* Tab for Details)



Click to Enlarge
Mount Shown with
Optional POLARIS-N5
Removable Knobs



Click to Enlarge
Methods of Adjusting the POLARIS-K1S4 Ø1"
Mount:

- A: 5/64" or 2.0 mm Hex Key in the End of the Adjuster
- B: SA1 Tool Through Adjuster Side Holes
- C: POLARIS-N5 Removable Knobs on the Adjuster
- D: HKTS-5/64 Hex Knobs with 1/16" or 1.5 mm Balldriver Through Side Holes for Fine Adjustment

This 2-Adjuster Ø1" Polaris Kinematic Mirror Mount is designed to provide easy high-resolution adjustment and long-term alignment stability. The mount features a monolithic flexure arm that can be actuated using the included screw and a 0.05" (1.3 mm) hex key. The monolithic flexure arm design keeps wavefront distortion on the mounted optic to a minimum while providing an optic retention force that is much stronger than the force provided by our other Ø1" Polaris mounts that use a setscrew and flexure spring design, as shown in the *Test Data* tab.

The 2-adjuster design improves mount stability by limiting the available degrees of freedom for movement. Compared to the POLARIS-K1-2AH and POLARIS-K1E2 Ø1" mounts, the stiffer springs used in the construction of the POLARIS-K1S4 provide enhanced stability, making this mount an ideal solution for OEM applications that require reliable operation in rugged environments.

The 100 TPI adjusters feature three Ø0.07" through holes that allow for actuation from the side using our precision-fit SA1 Side Hole Adjustment Tool (sold below) or a 1/16" (1.5 mm) balldriver or hex key. Each adjuster also has a 5/64" (2.0 mm) hex and may be adjusted with the hex on the end of the SA1, our HKTS-5/64 Hex Key Thumbscrews (sold below), or any other 5/64" (2.0 mm) hex wrench. Alternatively, POLARIS-N5 removable, low-profile adjustment knobs (sold below) can be threaded onto the adjusters for improved feel in fine-resolution adjustments; note that the removable knobs will block the adjuster side holes but not the hex. The adjusters on this mount can be locked using the POLARIS-LN1 lock nuts or POLARIS-LNS1 locking collars (sold separately below).

Post mounting is provided by two #8 (M4) counterbores at 90°. For custom mounting configurations, two Ø2 mm alignment pin holes are located on each mounting face for setting a precise location and mounting angle. Standard DIN 7-m6 ground dowel pins are recommended (click on the red documents icon below for details). We recommend using this mount with a stainless steel post that also has Ø2 mm alignment pin holes, such as our Ø1" Posts for Polaris Mirror Mounts.

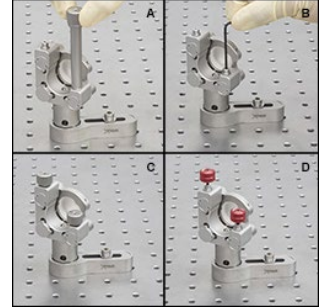
POLARIS-K1S4 Mounts purchased before September 21, 2016 cannot be used with the POLARIS-N5 Removable Knobs sold below. To order compatible knobs, please contact techsupport@thorlabs.com.

Part Number	Description	Price	Availability
POLARIS-K1S4	Polaris® Ø1" Mirror Mount, 2 Hex Adjusters with Side Holes, Monolithic Optic Retention	\$181.74	Today

Polaris® Ø1" Kinematic Mirror Mounts, 2 Vertical-Drive Adjusters, Monolithic Optic Retention



- ▶ Designed for use with Ø1" Optics
- ▶ ±4° Mechanical Angular Range
- ▶ ~7.7 mrad/rev Resolution
- ▶ 100 TPI Matched Actuator/Body Pairs
- ▶ Less than 1 µrad Deviation after Temperature Cycling (See the *Test Data* Tab for Details)
- ▶ Patented Monolithic Flexure Arm Design for Minimal Optic Distortion and Improved Optic Holding Stability (US Patent 10,101,559, See the *Test Data* Tab for Details)
- ▶ Patented Transverse Drive Design (US Patent 11,320,621)
- ▶ Right- and Left-Handed Versions Available



- Click to Enlarge
Using the POLARIS-K1VS2 Ø1" Mount:
- A: POLARIS-T2 Tool for Adjusting POLARIS-LNS1 Collars
 - B: 5/64" or 2.0 mm Hex Key in the End of an Adjuster
 - C: POLARIS-N5 Removable Knobs on the Adjusters*
 - D: HKTS-5/64 Hex Knobs on the Adjusters
A similar process can be used for the POLARIS-K1VS2L.

These 2-Adjuster Ø1" Polaris Kinematic Mirror Mounts provide long-term stability and high-resolution adjustment using vertical drives, allowing for adjustment in situations where there may not be space behind the mount for horizontal access to the adjusters. The 2-adjuster design improves mount stability by limiting the available degrees of freedom for movement. Compared to the POLARIS-K1-2AH and POLARIS-K1E2 2-adjuster mounts above, the stiffer springs used in the construction of these vertical-drive mounts provide enhanced stability, making them an ideal solution for OEM applications that require reliable operation in rugged environments. Right-handed and left-handed versions are available.

To secure an optic, the mounts use a monolithic flexure arm that can be actuated using the included screw and a 0.05" (1.3 mm) hex key. The monolithic flexure arm design keeps wavefront distortion on the mounted optic to a minimum while providing strong optic retention force (see the *Test Data* tab for details).

Product Highlight: Polaris Vertical Mirror Mount The 100 TPI adjusters feature a 5/64" (2.0 mm) hex and may be adjusted with our HKTS-5/64 Hex Key Thumbscrews, the hex on the end of the SA1 Adjustment Tool, or any other 5/64" (2.0 mm) hex wrench.

Alternatively, POLARIS-N5 removable, low-profile adjustment knobs can be threaded onto the adjusters for improved feel in fine-resolution adjustments, although mechanical angular range may be reduced.

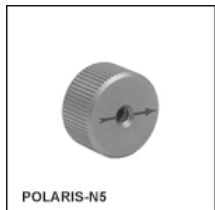
The adjusters on these mounts can be locked using the POLARIS-LNS1 locking collars. Two are pre-installed on the mounts, one for each adjuster. The included locking collars can be loosened or tightened most easily using the POLARIS-T2 spanner wrench.

Post mounting is provided by two #8 (M4) counterbores. For custom mounting configurations, two Ø2 mm alignment pin holes are located on each mounting face for setting a precise location and mounting angle. Standard DIN 7-m6 ground dowel pins are recommended (click on the red documents icon below for details). We recommend using these mounts with stainless steel posts that also have Ø2 mm alignment pin holes, such as our Ø1" Posts for Polaris Mirror Mounts.

*POLARIS-N5 Removable Knobs thread directly onto the exposed adjuster screws. Using them on the POLARIS-K1VS2 or POLARIS-K1VS2L may result in a reduced mechanical angular range.

Part Number	Description	Price	Availability
POLARIS-K1VS2	Polaris® Right-Handed Ø1" Mirror Mount, 2 Vertical-Drive Hex Adjusters, Monolithic Optic Retention	\$376.69	Lead Time
POLARIS-K1VS2L	Polaris® Left-Handed Ø1" Mirror Mount, 2 Vertical-Drive Hex Adjusters, Monolithic Optic Retention	\$376.69	Lead Time

Removable Knob for 1/4"-100 Adjusters



- ▶ For Convenient Adjustment of 1/4"-100 Adjusters
- ▶ Attaches Directly to Adjuster Threading
- ▶ Sold Individually

The Polaris® Removable Knobs for 1/4"-100 Adjusters allows the user to adjust a Polaris kinematic mirror mount by hand. The knobs can be used with select Polaris mounts, listed in the table to the right. Note that when the knobs are used with any of these mounts, they will block the side through holes on the adjuster. The adjuster screw's 5/64" (2 mm) hex socket is still usable when the knobs are attached.

The knobs are made from chemically cleaned and heat-treated 303 stainless steel that provides vacuum compatibility down to 10⁻⁹ Torr at 25 °C with proper bake out (10⁻⁵ Torr at 25 °C without bake out).

Compatible Mounts

POLARIS-K25S4/M
POLARIS-K25F4/M
POLARIS-K1C4
POLARIS-K1G4
POLARIS-K1S4
POLARIS-K1S5
POLARIS-K15S4
POLARIS-K15F4
POLARIS-K50S4/M
POLARIS-K50F4/M
POLARIS-K2VS2



Click to Enlarge
POLARIS-K1C4 Mount
with Optic and
Optional POLARIS-N5
Removable Knobs

POLARIS-K1C4 and POLARIS-K1S4 Mounts purchased before September 21, 2016 cannot be used with the POLARIS-N5 Removable Knobs sold here. To order compatible knobs, please contact Tech Support.

POLARIS-K2VS2L

Part Number	Description	Price	Availability
POLARIS-N5	Polaris® Removable Knob for 1/4"-100 Adjusters with Side Holes, Qty. 1	\$9.73	Today

[Hide 1/4"-100 Large Adjustment Knob](#)

1/4"-100 Large Adjustment Knob



- ▶ Ø0.925" Knob for Additional Angular Resolution
- ▶ Clearance Hole Allows Access to Hex Socket of the Adjuster

This removable adjustment knob is compatible with many of our 1/4"-100 adjusters, including those used in the Ø1", Ø1.5", and Ø2" Polaris Kinematic Mounts and our Polaris Kinematic Platform Mount. The larger Ø0.925" size provides additional angular resolution over the standard Polaris knobs.

Please note that the F25USK2 knob is not compatible with Polaris mounts that use side-hole adjusters.

The recessed bore of knob is not deep enough to allow the knob to engage the threads on the side-hole adjuster.



Click to Enlarge
F25USK2 Knob Shown
Attached to a POLARIS-K1
Mirror Mount

Part Number	Description	Price	Availability
F25USK2	Ø0.925" 1/4"-100 Removable Adjuster Knob	\$9.79	Today

[Hide 5/64" Hex Key Adjusters](#)

5/64" Hex Key Adjusters



- ▶ For Convenient Adjustment of 5/64" and 2 mm Hex-Driven Actuators
- ▶ Red Anodized Adjustment Knob with Engraved Hex Size
- ▶ Replaceable Hex Tip
- ▶ Sold in Packages of 4

These 5/64" Hex Key Adjuster Thumbscrews allow for quick adjustment of many 5/64" and 2 mm hex-driven actuators (or standard actuators with the knobs removed). These temporary knobs can be left in the screw's hex socket between adjustments for convenience (see photo to the right). An 8-32 setscrew (5/64" hex) secures the replaceable hex bit, which can be reversed if the tip is stripped. Contact Tech Support to order replacement hex key bits.

We offer hex key thumbscrews in sizes from 0.050" to 3/16" and 2 mm to 5 mm.



Click for Details
POLARIS-K1-2AH with HKTS-
5/64 Adjuster

Part Number	Description	Price	Availability
HKTS-5/64	Customer Inspired! 5/64" (2 mm) Hex Key Thumbscrew, 4 Pack	\$27.86	Today

[Hide Side Hole Adjustment Tool for Polaris® Mounts](#)

Side Hole Adjustment Tool for Polaris® Mounts



- ▶ Ø0.07" Precision-Fit Tip for Side Holes on Polaris Adjusters
- ▶ 5/64" (2.0 mm) Hex on Handle
- ▶ Magnetic, Chemically Cleaned Stainless Steel

The Side Hole Adjustment Tool features a Ø0.07" precision-fit tip designed for Polaris mounts with side hole adjusters. The handle features a 5/64" (2.0 mm) hex allowing the SA1 to act as a small knob, and the central nut is compatible with a 6.0 mm wrench allowing for a longer lever arm. The precision-fit tip minimizes backlash during

adjustments and the depth stop allows the tool to rest securely in a side hole between adjustments. On Ø25 mm mirror mounts and larger, the 1.62" length allows the tool to adjust the actuator 360° without interfering with the other adjuster on the back of the mount.

The SA1 is made of chemically cleaned, hardened, super alloy stainless steel for durability and compatibility with clean environments. The tool is also magnetic allowing it to be easily retrieved from tight or sensitive setups using a magnet.



Click to Enlarge
The SA1 tool can be used to adjust a
POLARIS-K1S4 mount using the side holes
(left) or rear hex (right).

Part Number	Description	Price	Availability
SA1	Customer Inspired! Side Hole Adjustment Tool for Polaris Mounts, Ø0.07" Tip, 5/64" (2.0 mm) Hex	\$35.45	7-10 Days

[Hide 1/4"-100 Adjuster Lock Nut for Polaris® Mounts](#)

1/4"-100 Adjuster Lock Nut for Polaris® Mounts



- ▶ Provides Long Term Adjuster Stability
- ▶ Compatible with Select Polaris Mounts
- ▶ 0.08" (1.9 mm) Thick
- ▶ 13 mm Hex can be Tightened with Thin-Head or Cone Wrench

To install a lock nut without cross threading, gently place the lock nut against the end of the adjuster. "Unscrew" the nut until the threads of the nut and the adjuster align before threading the nut onto the adjuster. This animation shows the installation of a POLARIS-LN1 lock nut on a POLARIS-K1F1 low distortion mount.

This lock nut is compatible with Polaris mounts that have 1/4"-100 adjusters, excluding the piezo-driven mounts, mounts with low-profile adjusters (Item #s POLARIS-K1-H, POLARIS-K1-2AH, POLARIS-K1E3, and POLARIS-K1E2), and vertically driven mounts (Item #s POLARIS-K1VS2 and POLARIS-K1VS2L). Designed for long-term adjuster stability or applications that are exposed to shock and vibration, the lock nut is pre-greased with the same ultra-high-vacuum-compatible, low-outgassing PTFE grease as the Polaris mounts and has been tested for adjuster fit.

For applications that require frequent tuning of the adjusters, the lock nuts only need to be lightly tightened by hand to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). For long term stability, we recommend tightening to a torque of 32 oz-in, which can be achieved by using our TW13 preset torque wrench (sold below). POLARIS-LN1 lock nuts have a 13 mm hex. To avoid cross threading the lock nut, place it against the adjuster and "unscrew" the lock nut until you feel a slight drop; then thread the lock nut onto the adjuster.

Part Number	Description	Price	Availability
POLARIS-LN1	1/4"-100 Lock Nut, 13 mm Hex, Stainless Steel	\$9.14	Today

[Hide 1/4"-100 Adjuster Locking Collar for Polaris® Mounts](#)

1/4"-100 Adjuster Locking Collar for Polaris® Mounts



- ▶ Provides Long Term Adjuster Stability
- ▶ Compatible with Select Polaris Mounts
- ▶ Low Profile: Ø0.33" (Ø8.4 mm) x 0.08" (1.9 mm) Thick
- ▶ Tighten Along Rotational Axis Using the POLARIS-T2 Spanner Wrench

This locking collar is compatible with Polaris mounts that have 1/4"-100 adjusters, excluding the piezo-driven mounts and mounts with low-profile adjusters (Item #s POLARIS-K1-H, POLARIS-K1-2AH, POLARIS-K1E3, and POLARIS-K1E2). Designed for long-term adjuster stability or applications that are exposed to shock and vibration, these locking collars are pre-greased with the same ultra-high-vacuum-compatible, low-outgassing PTFE grease as the Polaris mounts and have been tested for adjuster fit.

The POLARIS-T2 spanner wrench has been specifically designed for use in securing the POLARIS-LNS1 locking collar. The double spanner head enables complete engagement while the design allows locking collar adjustments to be along the same line as the adjuster itself. A center through hole allows a 2 mm ball driver to pass through the spanner wrench, so that the adjuster can be held in position while the locking collar is engaged.

For applications that require frequent tuning of the adjusters, the locking collar only needs to be lightly tightened to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). For long term stability, we recommend tightening to a torque of 32 oz-in, which can be achieved by using our TW13 preset torque wrench (sold below) in combination with the POLARIS-T2 spanner wrench. To avoid cross threading the locking collar, place it against the adjuster and "unscrew" the collar until you feel a slight drop; then thread the collar onto the adjuster.

Part Number	Description	Price	Availability
POLARIS-T2	Spanner Wrench for POLARIS-LNS1 Locking Collar	\$53.81	Today
POLARIS-LNS1	1/4"-100 Locking Collar, Stainless Steel	\$10.76	Today

[Hide Torque Wrench for Polaris® Lock Nuts](#)

Torque Wrench for Polaris® Lock Nuts



- ▶ 13 mm Hex for Use with POLARIS-LN1 Lock Nut and POLARIS-T2 Spanner Wrench, as well as POLARIS-LN4 Lock Nut
- ▶ Preset Torque Value of 32 oz-in (0.23 N·m)
- ▶ Break-Over Design Ensures Proper Torque is Applied
- ▶ Ideal for Applications Requiring Long-Term Locking



Click to Enlarge
The TW13 wrench is engraved with its preset torque value and item #.



Click to Enlarge
TW13 Torque Wrench Used to Secure POLARIS-LN1 Lock Nut on POLARIS-K2S2 Mirror Mount

This torque wrench has a preset torque value of 32 oz-in for use with the POLARIS-LN1 lock nut used on Polaris® mounts as well as the POLARIS-T2 spanner wrench. The wrench is also compatible with the POLARIS-LN4 lock nut. When the preset torque value has been achieved, the break-over design will cause the pivoting joint to "break," as shown to the right. The wrench's hex head will move back into place once the force is removed. This design prevents further force from being applied to the lock nut. Engraved guidelines indicate the angle the wrench should pivot in order to apply the specified torque; pivoting the handle past these guidelines will over-torque the lock nut. The wrench is also engraved with its preset torque value, torque direction, wrench size, and item # for easy identification in the field.

This wrench is designed to be compatible with cleanroom and vacuum chamber applications. It is chemically cleaned using the Carpenter AAA passivation method to remove sulfur, iron, and contaminants from the surface. After passivation, it is assembled in a clean environment and double vacuum bagged to eliminate contamination when transported into a cleanroom. The wrench has a bead blasted finish to minimize reflections when working with setups that include lasers.

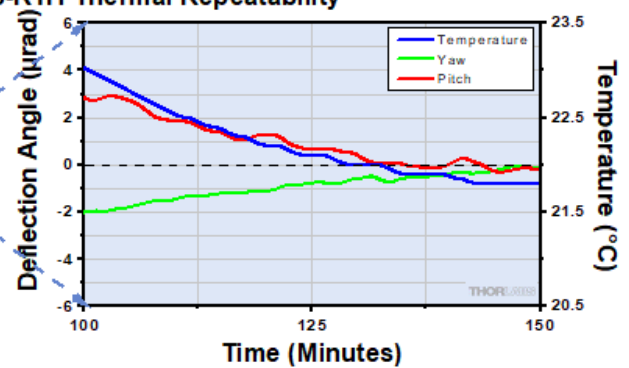
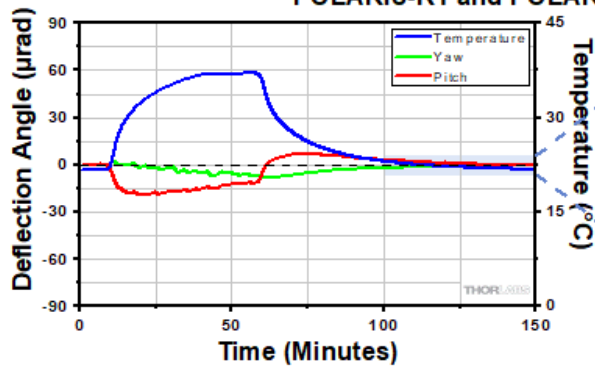
Please note that these wrenches are not intended for use in applications where adjusters are frequently tuned, as these applications typically require torque values of 4 to 8 oz-in (0.03 to 0.06 N·m).

Part Number	Description	Price	Availability
TW13	Customer Inspired! 13 mm Preset Torque Wrench for Polaris Lock Nuts, 32 oz-in	\$126.69	7-10 Days





POLARIS-K1 and POLARIS-K1H Thermal Repeatability



POLARIS-K1-H
Mirror Not Included



Back View



Flexure Locking
Mechanism

Front View