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THORLABS

POLARIS-K1PZ2 - JAN 3, 2018

Item # POLARIS-K1PZ2 was discontinued on JAN 3, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

POLARIS® KINEMATIC MIRROR MOUNTS WITH PIEZOELECTRIC ADJUSTERS

- ► Designed for Long-Term Stability
- ► Minimal Temperature-Dependent Hysteresis
- ► Sapphire Adjuster Seats Prevent Wear Over Time
- ► Each Actuator Contains Internal Piezo Element for Fine Adjustment

OVERVIEW

Features

- Machined from Heat-Treated Stainless Steel with Low Coefficient of Thermal Expansion (CTE)
- Fully Integrated Piezoelectric Elements Provide Step Sizes Down to 0.5 μrad
- Matched Actuator and Back Plate Provide Smooth Manual Kinematic Adjustment
- Hardened Stainless Steel Ball Contacts with Sapphire Seats for Durability and Smooth Movement
- Passivated Stainless Steel Surface Ideal for Vacuum and High-Power Laser Cavity Applications
- Extensive Testing Guarantees Less than 6 μrad Deviation After 15 °C Temperature Cycling (See *Test Data* Tab)
- Custom Mount Configurations are Available by Contacting Tech Support

The Polaris® Kinematic Mirror Mounts with Piezoelectric Adjusters are the ultimate solution for applications requiring stringent, actively monitored, long-term alignment stability.

A replacement piezoelectric adjuster for these mounts is also available separately below.

Key Specifications[a]			
Optic Size	**Ø1/2"**	**Ø1"**	**Ø2"**
Optic Thickness (Min)	0.08" (2 mm)		0.14" (3.5 mm)
Mechanical Angular Range	±5°	±5°	±3.4°
Piezoelectric Angular Range	>490 μrad	>500 μrad	>280 μrad
Adjusters	Manually Adjustable 100 TPI Screws with Integrated Piezoelectric Elements		
Piezo Control Voltage	0 to 150 V		
Piezo Connectors	Male SMB (SMB-to-BNC Cables Included)		
Beam Deviation after Temperature Cycling[b]	<6 μrad	<3 μrad	<2 μrad
Mounting	Two #8 (M4) Counterbores		Four #8 (M4) Counterbores

- Please see the *Specs* tab for complete specifications.
- While the Polaris mount was physically disconnected from its piezo controller (zero bias), the ambient temperature was increased by 15 °C, then allowed to return to room temperature. For more details, please see the *Test Data* tab.

Optic Retention
These Polaris mounts use either a monolithic flexure arm or a flexure spring and setscrew combination to hold the optic. These designs provide high holding force and pointing stability with minimal optic distortion. For more details, see the *Test Data* tab.

Polaris optic bores are precision machined to achieve a fit that will provide optimum beam pointing stability performance over changing environmental conditions such as temperature changes, transportation shock, and vibration. Performance will be diminished if the mounts are used with optics that have an outer diameter tolerance greater than +0/-0.1 mm, such as metric mirror sizes (Ø12.5 mm, Ø25 mm, or Ø50 mm). To order a mount designed for metric optics, please contact Tech Support.

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 more information.

Our design incorporates high-adjustment-sensitivity piezoelectric stacks directly into the hardened stainless steel adjusters, enabling smooth coarse and fine movements along each axis. When used in a closed feedback loop, these mounts combine the exceptional thermal stability of our standard Polaris® kinematic mirror mounts with the ability to actively correct the beam pointing (see the *Application* tab). Like all Polaris mounts, they are machined from heat-treated stainless steel, utilize precision-matched adjusters, and incorporate ball contacts and sapphire seats at all contact points.

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.

Vacuum Compatibility
All Polaris mounts on this page are designed to be compatible with cleanroom and vacuum applications. See the *Specs* tab and the *Design Features* tab for details. The included SMB-to-BNC cables are not vacuum compatible.

SPECS

Item #	POLARIS-K05P2	POLARIS-K1PZ	POLARIS-K1PZ2	POLARIS-K2S2P
Optic Specifications				
Optic Sizes[a]	Ø1/2"	Ø1"		Ø2"
Optic Thickness (Min)	0.08" (2 mm)			0.14" (3.5 mm)
Optic Mounting Torque	6 to 10 oz-in for 6 mm Thick Optics (Recommended)			4 to 6 oz-in for 12 mm Thick Optics (Recommended)
Beam Deviation after Temperature Cycling[b]	<6 µrad	<3 µrad		<2 µrad
Adjuster Specifications				
Number of Adjusters	2	3	2	2
Angular Range	Mechanical: ±5° Piezo: >490 µrad	Mechanical: ±5° Piezo: >500 µrad		Mechanical: ±3.4° Piezo: >280 µrad
Angular Resolution	Mechanical: ~14 mrad/rev Piezo: ~0.5 µrad for a 0.1 V Step[c]	Mechanical: ~7 mrad/rev Piezo: ~0.5 µrad for a 0.1 V Step[c]		Mechanical: ~4.75 mrad/rev Piezo: ~0.18 µrad for a 0.1 V Step[c]
Adjusters	Manually Adjustable 100 TPI Screws with Integrated Piezoelectric Elements and Matched Actuator/Body Pairs			
Piezo Control Voltage	0 to 150 V			
Piezo Connectors	Male SMB (One SMB-to-BNC Cable Included for Each Adjuster)			
Compatible Piezo Controllers	MDT693B Three-Axis Benchtop Controller MDT694B Single-Axis Benchtop Controller[d] KPZ101 Single-Axis K-Cube Controller[d,e]			
Physical Specifications				
Mechanical Drawing				
Mounting	Two #8 (M4) Counterbores			Four #8 (M4) Counterbores
Alignment Pin Holes	Two Ø2 mm Holes for DIN 7-m6 Ground Dowel Pins at Each Counterbore	N/A		Two Ø2 mm Holes for DIN 7-m6 Ground Dowel Pins at Each Mounting Face
Vacuum Compatibility	10^{-5} Torr at 20 °C Epoxy Meets Low Outgassing Standards NASA ASTM E595, Telcordia GR-1221			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	-25 °C to 130 °C	-25 to 85 °C		

- For best performance, use optics with a diameter tolerance of up to +0/-0.1 mm.
- While the Polaris mount was physically disconnected from its piezo controller (zero bias), the ambient temperature was increased by 15 °C, then allowed to return to room temperature. For more details, please see the *Test Data* tab.
- Measured by incrementing and decrementing the voltage applied by a KPZ101 K-Cube controller in 0.1 V steps.
- One controller is required per independently controlled axis.
- Requires a BNC female to SMC female adapter.

TEST DATA

Polaris® Mirror Mount Test Data

Polaris Kinematic Mirror Mounts undergo extensive testing to ensure high-quality performance.

After mounting the Polaris to a Ø1" stainless steel post, the mirror and post assembly was secured to a stainless steel optical table in a temperature-controlled environment. The mirror was secured using the flexure spring, not glued; 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.

Angular Tuning Range of Piezoelectric Adjusters

Purpose: This test was done to determine the full adjustable range of the piezoelectric stack inside the adjuster screw.

Procedure: Each axis was connected to one of our KPZ101 Single-Channel K-Cube Piezo Controllers (set in manual mode) or to a single channel on our MTD693B Three-Axis Benchtop Controller. The voltage was increased from 0 to 150 V, the maximum control voltage, in 5 V steps (blue line). Then the voltage was decreased from 150 V to 0 V, again using 5 V steps (red line).

Results: The maximum deflection that can be imparted by the piezoelectric stack is shown in the plots in the expandable tables below. This maximum deflection is >490 µrad for the Ø1/2" mount, >500 µrad for the Ø1" mounts, and >280 µrad for the Ø2" mounts. The well-known hysteresis response of piezoelectric materials is also evident. That is, the displacement at a given voltage depends upon whether the applied voltage is increasing or decreasing.

Ø1/2" Piezoelectric Mount Angular Adjustment
Ø1" Piezoelectric Mounts Angular Adjustment
Ø2" Piezoelectric Mount Angular Adjustment

Positional Repeatability After Thermal Shock

Purpose: This testing was done to determine how reliably the mount returns the mirror to its initial position so that the alignment of the optical system is unaffected by the temperature shock.

Procedure: The ambient temperature was raised by 15 °C over a period of at least 45 minutes. Then the temperature was allowed to return to near room temperature. During these tests, the piezo actuators were not connected to a voltage source. The worst-case results obtained by this method are shown below.

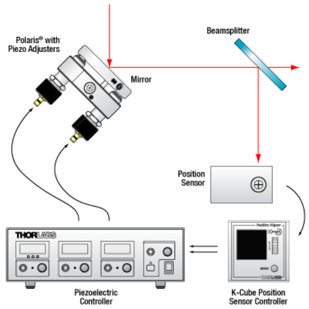
Results: The thermal shock data for each Polaris mount is shown in the plots in the expandable tables below. As shown in the plots, when the Polaris mount was returned to its initial temperature, the mirror position returned to within 6 µrad of its initial position for the Ø1/2" mount, within 3 µrad for the Ø1" mounts, and within 2 µrad for the Ø2" mount.

For Comparison: To get a 1 µrad change in the mount's position, the 100 TPI adjuster on the Ø1/2" Polaris mount needs to be rotated by only 0.025° (1/14400 of a turn). A highly skilled operator might be able to make an adjustment as small as 0.6° (1/1200 of a turn), which corresponds to 12 µrad.

Conclusions: These Polaris mirror mounts are high-quality, ultra-stable mounts that will reliably return a mirror to within several µrad of its original position after cycling through a temperature change in an open-loop setup. With a large adjustable range on each axis and a typical step size of 0.5 µrad (for a 0.1 V change in applied voltage), the Polaris mounts are capable of providing sub-µrad alignment stability in a closed-loop setup, even under punishing experimental conditions.

Ø1/2" Piezoelectric Mount Thermal Shock
Ø1" Piezoelectric Mounts Thermal Shock
Ø2" Piezoelectric Mount Thermal Shock

APPLICATION



Click for Details
Polaris Kinematic Mirror Mount as Part of a Closed-Loop System

Polaris® Mirror Mount in a Beam Stabilization Setup

Active beam stabilization is often used to compensate for beam drift (unintended beam pointing deviations) in experimental setups. Drift can be caused by insecurely mounted optics, laser source instabilities, and thermal fluctuations within an optomechanical setup. In addition to correcting for setup errors, active stabilization is frequently used in laser cavities to maintain a high output power or used on an optical table to ensure that long measurements will take place under constant illumination conditions. Setups with long beam paths also benefit from active stabilization, since small angular deviations in a long path will lead to significant displacements downstream.

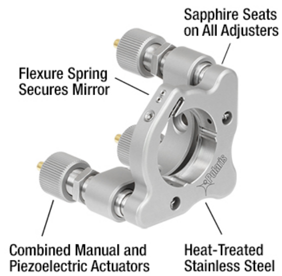
An example of a beam stabilization setup is shown in the schematic to the left. A beamsplitter inserted in the optical path sends a sample of the beam to a position sensor that monitors the displacement of the beam relative to the detector's center. (For optimal stabilization, the beamsplitter should be as close as possible to the measurement.) The position detector outputs an error signal in X and Y that is proportional to the beam's position. Each error signal is fed into a channel of a piezoelectric controller that steers the beam back to the center of the sensor.

The setup illustrated here stabilizes the beam to a point in space. In order to stabilize the beam over a beam path (i.e., over two points in space), two piezoelectric mirror mounts, as well as the associated electronics, are required. Suggested electronics for a beam stabilization setup are given in the table below.

Suggested Components	
Description	**Item #**
Polaris Mirror Mount with Piezo Adjusters (Choose One)	POLARIS-K05P2, POLARIS-K1PZ, POLARIS-K1PZ2, or POLARIS-K2S2P
Piezoelectric Controller (Choose One)	MDT693B Three-Axis Benchtop Controller, MDT694B Single-Axis Benchtop Controller[a], or KPZ101 Single-Axis K-Cube Controller[a]
Position Sensor (Choose One)	PDP90A (320 - 1100 nm), PDQ80A (400 - 1050 nm), or PDQ30C (1000 - 1700 nm)
K-Cube Position Sensor Controller	KPA101

- One controller is required per independently controlled axis.

DESIGN FEATURES



Click to Enlarge
Details of the Polaris Design. The POLARIS-K2S2P uses a monolithic flexure arm instead of the flexure spring and setscrew combination shown here.

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, they use a flexure spring 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 flat spring is sufficient to keep the mirror locked into place regardless of the ambient temperature.

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 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.

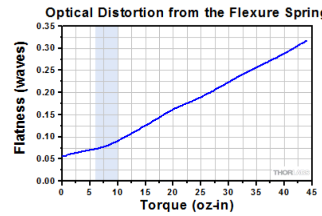
Integrated Piezoelectric Stacks
Each adjuster screw incorporates a piezoelectric stack inside the body of the actuator, seated directly behind the tip. This in-line design keeps the number of ball contact points to a minimum, reduces the number of moving parts, and ensures that the low crosstalk guaranteed by our precision-machined components is not compromised. Whether being moved by hand or by the piezoelectric stack, the adjusters make use of the same sapphire-to-hardened-steel contact points to provide precise motion for the life of the mount.

Compatible with Vacuum Environments
Each component has been carefully selected to ensure vacuum compatibility. The epoxy used to bond the sapphire seats in place is baked using a NASA-approved low-outgassing procedure. DuPont LVP High-Vacuum (Krytox) Grease, an ultra-high-vacuum-compatible, low-outgassing PTFE grease is used with the adjusters. The piezoelectric stack is sheathed by a thin, low-solvent-content acrylic material that supports vacuum environments down to at least 10^{-5} Torr. For the piezo connector, we chose PTFE, a non-hygroscopic plastic, as the insulating layer. All electrical contacts are made by a fluxless solder.

Please note that a high-voltage ConFlat flange is required to pass the piezo control voltage into vacuum. The included SMB-to-BNC cables are not vacuum compatible.

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.



Click to Enlarge
Optic distortion of a BB1-E02 mirror mounted in a Ø1" Polaris mount. At zero torque, the sample mirror's flatness was λ/20 over the clear aperture (λ = 633 nm). The shaded region indicates the recommended amount of torque.

General Usage Tips

Match Materials
Due to its relatively low coefficient of thermal expansion, stainless steel was chosen as the material from which to fabricate the Polaris mount. When mounting the Polaris, we recommend using components fabricated from the same material.

Use a Wide Post
The Polaris' performance is optimized for use with a Ø1" optical post. These posts are made of 303 stainless steel and provide two planes 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 a Polaris mount. Over torquing the flexure spring optic retainer can result in dramatic surface distortions. The graph to the right shows surface distortions that result from increasing torque values delivered by the TD24 Torque Wrench for the front plate used in the POLARIS-K1PZ and POLARIS-K1PZ2 with a Ø1", 6 mm thick BB1-E02 mirror mounted in it. The test was stopped once the distortion was greater than 0.3 waves.

Front Plate's Position
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 adjustment stability.

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.

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 a polishing pad (LFG1P) for the top and bottom of the post as well as the bottom of the mount.

Piezo Usage Tips

Click to Enlarge
The RS05PC Ceramic Pedestal Post electrically and thermally isolates the Polaris mount from the optical table.

Mount on a Ceramic Pedestal Post
Thorlabs' Ø1" (Ø25.0 mm) pillar posts can be secured to an RS05PC Ceramic Pedestal Post for increased thermal and electrical isolation, as shown to the right. The glass-mica ceramic insulates the Polaris mount from the optical table or breadboard, preventing potential electrical loops from forming that can increase the noise seen by the piezo connector and lead to beam drift. Please note that mounting a Polaris mount on a Ø1" (Ø25.0 mm) pillar post requires the use of the thread adapter included with the post.

Disconnect Unused Channels
If active stabilization of a given axis is not needed, then it is not necessary to connect the unused axis to a piezoelectric controller. Any noise on the electrical connection may cause an undesired movement in the beam.

Connect Cables only when Power Supply is Off
The piezoelectric stacks may be irreversibly damaged by abrupt changes in the applied voltage. In order to prevent such damage, ensure that the power supply is off before connecting the SMB cable.

Use Gentle Voltage Steps
Abrupt charging or discharging of the piezoelectric actuator may cause irreversible damage to the piezo.

Stay within the 0 - 150 V Control Voltage Range
Applying voltages less than 0 V (negative voltages) or greater than 150 V may cause irreversible damage to the piezo.

Handle with Care
Piezoelectrics are ceramic materials, and therefore relatively brittle as compared to common optomechanics. Hence, they are sensitive to shock forces. Do not drop the mount or place it in a box without protective cushioning.

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, crack the sapphire seats, or break the piezoelectric stacks. Finally, do not overtighten 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.

POLARIS FAMILY

Thorlabs offers several different general varieties of Polaris mounts, including kinematic side optic retention, SM-threaded, low optic distortion, piezo-actuated, and glue-in optic mounts, as well as a fixed monolithic mirror mount and fixed optic mounts. Click to expand the tables below and see our complete line of Polaris mounts, listed by optic bore size, and then arranged by optic retention method and adjuster type. We also offer a line of accessories that have been specifically designed for use with our Polaris mounts; these are listed in the table immediately below.

Polaris Mount Optic Retention Methods (Click Image to Enlarge)			
Side Lock	SM Threaded	Low Distortion	Glue In
			

Polaris Mount Adjuster Types (Click Image for Details)				
Side Hole	Hex	Adjuster Knobs	Adjuster Lock Nuts	Piezo Adjusters
				

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

Accessories for Polaris Mounts
Ø1" Posts for Polaris Mirror Mounts
Polaris Clamping Arm
Polaris 45º Adapter

Polaris Mounts for Ø1/2" Optics More [+]

Polaris Mounts for Ø19 mm (3/4") Optics More [+]

Polaris Mounts for Ø25 mm Optics More [+]

Polaris Mounts for Ø1" Optics More [+]

Polaris Mounts for Ø50 mm Optics More [+]

Polaris Mounts for Ø2" Optics More [+]

Polaris Mounts for Ø3" Optics More [+]

Polaris Kinematic Platform Mount More [+]

Ø1/2" Polaris® Kinematic Mirror Mount, 2 Piezoelectric Adjusters

- 2-Adjuster Piezoelectric and Knob-Driven Design
- Designed for Use with Ø1/2" Optics
- 100 TPI Screws with Integrated PK4DMP1 Piezoelectric Elements
- Less than 6 µrad Beam Deviation After Temperature Cycling (See the *Test Data* Tab)
- Two SMB-to-BNC Cables Included

[APPLIST]
[APPLIST]

Click to Enlarge

Click to Enlarge

Back and Front Views of the POLARIS-K05P2 Mirror Mount, Shown with a Ø1/2" Mirror and a Ø1" Polaris Post (Neither Included)

This Ø1/2" Kinematic Mirror Mount with Two Piezoelectric Adjusters is designed to provide long-term alignment stability in closed-loop systems. It offers exceptional angular resolution of ~0.5 µrad for a 0.1 V step via piezoelectric adjustment.

The Polaris design results in greater durability and thermal performance compared to non-Polaris mirror mounts. A flexure spring and setscrew combination provides temperature-independent retention of the optic, unlike nylon-tipped setscrews that are sensitive to temperature fluctuations. The setscrew that adjusts the flexure spring accepts a 1/16" (1.5 mm) hex key. We strongly recommend using a torque driver for securing the optic to prevent optical surface distortion and to improve thermal stability.

This mirror mount comes with two adjuster lock nuts that can be tightened by holding the adjuster knob while lightly tightening the lock nut by hand or with an 11 mm thin-head, open-ended hex wrench. Lock nuts only need to be lightly tightened to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). These lock nuts hold in place the manual adjustment and will not affect the fine piezoelectric adjustment of this mount. The mount is designed so that the knobs and lock nuts are flush with the bottom surface of the housng, allowing it to be directly mounted to an optical table or breadboard.

Post mounting is provided by two #8 (M4) counterbores located at right angles with respect to each other for right- or left-handed mounting. Due to the shallow design of the counterbores, low-profile 8-32 and M4 cap screws are included for mounting without obstructing the transmissive beam path. The 8-32 cap screw accepts a 5/64" (2 mm) hex wrench, while the M4 cap screw accepts a 2.5 mm hex wrench. For custom mounting configurations, Ø2 mm alignment pin holes are located on both sides of each counterbore for setting a precise location and mounting angle. Standard DIN 7-m6 ground dowel pins are recommended; see the Docs icon ( ) below for details.

Part Number	Description	Price	Availability
POLARIS-K05P2	**Polaris® Piezoelectric Ø1/2" Mirror Mount, 2 Adjusters with Lock Nuts, Cables Included**	**$811.00**	**Lead Time**

Ø1" Polaris® Kinematic Mirror Mount, 3 Piezoelectric Adjusters

- 3-Adjuster Piezoelectric and Knob-Driven Design
- Designed for Use with Ø1" Optics
- 100 TPI Screws with Integrated Piezoelectric Elements
- Less Than 3 µrad Beam Deviation After Temperature Cycling (See the *Test Data* Tab)
- Three SMB-to-BNC Cables Included

[APPLIST]
[APPLIST]

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Click to Enlarge

Back and Front Views of the POLARIS-K1PZ Mirror Mount, Shown with a Ø1" Mirror and a Ø1" Post (Neither Included)

This Ø1" Kinematic Mirror Mount with Three Piezoelectric Adjusters is designed to provide long-term alignment stability in closed-loop systems. It offers exceptional angular resolution of ~0.5 µrad for a 0.1 V step via piezoelectric adjustment.

The Polaris design results in greater durability and thermal performance compared to non-Polaris mirror mounts. A flexure spring and setscrew combination provides temperature-independent retention of the optic, unlike nylon-tipped setscrews that are sensitive to temperature fluctuations. The setscrew that adjusts the flexure spring accepts a 5/64" (2 mm) hex key. We strongly recommend using a torque driver for securing the optic to prevent optical surface distortion and to improve thermal stability.

This mirror mount comes with three adjuster lock nuts that can be tightened by holding the adjuster knob while lightly tightening the lock nut by hand or with a 12 mm thin-head, open-ended hex wrench. Lock nuts only need to be lightly tightened to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). These lock nuts hold in place the manual adjustment and will not affect the fine piezoelectric adjustment of this mount.

Post mounting is provided by two #8 (M4) counterbores located at right angles with respect to each other for right- or left-handed mounting. One 8-32 cap screw and one M4 cap screw are included for securing the mount to a post. The 8-32 cap screw accepts a 9/64" hex wrench, while the M4 cap screw accepts a 3 mm hex wrench.

Part Number	Description	Price	Availability
POLARIS-K1PZ	**Polaris® Piezoelectric Ø1" Mirror Mount, 3 Adjusters with Lock Nuts, Cables Included**	**$1,074.00**	**Today**

Ø1" Polaris® Kinematic Mirror Mount, 2 Piezoelectric Adjusters

- 2-Adjuster Piezoelectric and Knob-Driven Design
- Designed for Use with Ø1" Optics
- 100 TPI Screws with Integrated Piezoelectric Elements
- Less Than 3 µrad Beam Deviation After Temperature Cycling (See the *Test Data* Tab)
- Two SMB-to-BNC Cables Included

[APPLIST]
[APPLIST]


Click to Enlarge


Click to Enlarge

Back and Front Views of the POLARIS-K1PZ2 Mirror Mount, Shown with a Ø1" Mirror and a Ø1" Post (Neither Included)

This Ø1" Kinematic Mirror Mount with Two Piezoelectric Adjusters is similar to the 3-adjuster version sold above but features a hardened steel ball in place of the third adjuster. This mount is designed to provide long-term alignment stability in closed-loop systems. It offers exceptional angular resolution of ~0.5 µrad for a 0.1 V step via piezoelectric adjustment.

The Polaris design results in greater durability and thermal performance compared to non-Polaris mirror mounts. A flexure spring and setscrew combination provides temperature-independent retention of the optic, unlike nylon-tipped setscrews that are sensitive to temperature fluctuations. The setscrew that adjusts the flexure spring accepts a 5/64" (2 mm) hex key. We strongly recommend using a torque driver for securing the optic to prevent optical surface distortion and to improve thermal stability.

This mirror mount comes with two adjuster lock nuts that can be tightened by holding the adjuster knob while lightly tightening the lock nut by hand or with a 12 mm thin-head, open-ended hex wrench. Lock nuts only need to be lightly tightened to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). These lock nuts hold in place the manual adjustment and will not affect the fine piezoelectric adjustment of this mount.

Post mounting is provided by two #8 (M4) counterbores located at right angles with respect to each other for right- or left-handed mounting. One 8-32 cap screw and one M4 cap screw are included for securing the mount to a post. The 8-32 cap screw accepts a 9/64" hex wrench, while the M4 cap screw accepts a 3 mm hex wrench.

Part Number	Description	Price	Availability
POLARIS-K1PZ2	**Polaris® Piezoelectric Ø1" Mirror Mount, 2 Adjusters with Lock Nuts, Cables Included**	**$842.00**	**Today**

Ø2" Polaris® Kinematic Mirror Mount, 2 Piezoelectric Adjusters

- 2-Adjuster Piezoelectric and Knob-Driven Design
- Designed for Use with Ø2" Optics
- 100 TPI Screws with Integrated Piezoelectric Elements
- Less Than 2 µrad Beam Deviation After Temperature Cycling (See the *Test Data* Tab)
- Two SMB-to-BNC Cables Included

[APPLIST]
[APPLIST]


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Back and Front Views of the POLARIS-K2S2P Mirror Mount, Shown with a Ø2" Mirror and a Ø1" Post (Neither Included)

This Ø2" Kinematic Mirror Mount with Two Piezoelectric Adjusters is designed to provide long-term alignment stability in closed-loop systems. It offers exceptional angular resolution of ~0.5 µrad for a 0.1 V step via piezoelectric adjustment.

The Polaris design results in greater durability and thermal performance compared to non-Polaris mirror mounts. A monolithic flexure arm provides temperature-independent retention of the optic, unlike nylon-tipped setscrews that are sensitive to temperature fluctuations. The setscrew that adjusts the flexure arm accepts a 5/64" (2 mm) hex key. We strongly recommend using a torque driver for securing the optic to prevent optical surface distortion and to improve thermal stability.

This mirror mount comes with two adjuster lock nuts that can be tightened by holding the adjuster knob while lightly tightening the lock nut by hand or with a 12 mm thin-head, open-ended hex wrench. Lock nuts only need to be lightly tightened to a torque of approximately 4 to 8 oz-in (0.03 to 0.06 N·m). These lock nuts hold in place the manual adjustment and will not affect the fine piezoelectric adjustment of this mount.

Post mounting is provided by four #8 (M4) counterbores for right- or left-handed mounting. One 8-32 cap screw and one M4 cap screw are included for securing the mount to a post. The 8-32 cap screw accepts a 9/64" hex wrench, while the M4 cap screw accepts a 3 mm hex wrench.

Part Number	Description	Price	Availability
POLARIS-K2S2P	**Customer Inspired!Polaris® Piezoelectric Ø2" Mirror Mount, 2 Adjusters with Lock Nuts, Cables Included**	**$1,000.00**	**Today**

Replacement Piezoelectric Actuator with Bushing

- Manual Coarse Adjustment Range: 0.375"
- Piezoelectric Fine Adjustment Range: 15.4 µm (Min)
- 3/8"-100 Adjuster Mounted in Ø0.50" Stainless Steel Bushing
- Male SMB Connector (SMB-to-BNC Cable Not Included)

Specifications	
Manual Travel Range	0.375" (9.53 mm)
Manual Travel Resolution	0.26 mm/rev
Piezo Travel Range	15.4 µm (Min) 19.4 µm (Max)
Piezo Travel Resolution	0.017 µm for a 0.1 V Step[a]
Piezo Drive Voltage	0 to 150 V
Mechanical Drawing	

- Measured After Increasing and Decreasing the Voltage Applied while Using a KPZ101 Controller in 0.1 V Steps

The POLARIS-P20 is the piezoelectric actuator for the mirror mounts sold above. It can be used as a replacement adjuster for any Polaris piezoelectric mount by removing the adjuster screw from the bushing. The actuator can be manually adjusted for up to 0.375" of travel, while the piezoelectric fine adjustment has a maximum travel range between 15.4 µm and 19.4 µm. The adjuster screw and bushing are machined from stainless steel, which has a low coefficient of thermal expansion (CTE) for stability in environments with large temperature fluctuations. For details on using this piezoelectric actuator, please see the spec sheet.

The piezo actuator features a male SMB connector; an SMB-to-BNC cable is not included. The included adjuster lock nut can be tightened or loosened by hand or with a 12 mm thin-head, open-ended hex wrench. Holding the adjuster in place with the lock nut will not affect the piezoelectric adjustment.

We recommend driving this piezo actuator with the KPZ101, MDT693B, or MDT694B piezo controllers.

Part Number	Description	Price	Availability
POLARIS-P20	**NEW! Piezoelectric Actuator with Stainless Steel Bushing, 3/8" Manual Travel, ≥15.4 µm Piezo Travel**	**$250.00**	**3-5 Days**

Visit the *Polaris® Kinematic Mirror Mounts with Piezoelectric Adjusters* page for pricing and availability information:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=5035