

## Part# NX1F/M - April 14, 2015

Item # NX1F/M was removed from our e-commerce site on April 14, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### KINEMATIC BASES

- ▶ Square and Circular Magnetic Retention Bases
- ▶ Magnetic Mounting Seats for Aluminum Breadboards
- ▶ Indexing Mounts with 22.5° or 24° Increments
- ▶ Precision Ball and V-Groove Design for High Repeatability



**NX1N**  
Indexing Base  
with Ø1" Optic  
Mount,  
16 Positions



**SB1**  
Locking Circular Base



**NX1F**  
Indexing Base,  
15 Positions



**KB3X3**  
Magnetic Base,  
3" x 3"

**KBM1**  
Lockable Kinematic Breadboard,  
3.94" x 3.94"



[Hide Overview](#)

#### OVERVIEW

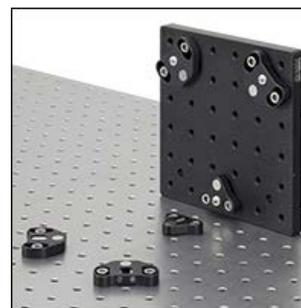
##### Features

- Insert and Remove Components with High Repeatability
- Ball and V-Groove Design for Precise Alignment
- Rare Earth Magnets Couple Top and Bottom Base Plates
- Top and Bottom Plates Available Individually or as Complete Unit

Kinematic bases are an excellent method for mounting elements that need to be inserted and removed from the optical path with a high degree of repeatability. Our ball and V-groove design allows the top plate to be kinematically positioned on the base plate with a high degree of precision. The two plates of the kinematic base are held together using pairs of rare-earth magnets.



Click to Enlarge  
KBM1 Locking Kinematic Base with  
CCD Camera Beam Profiler  
Mounted on a Ø1" Post



Click to Enlarge  
KBS98 Kinematic Seats Can Be Used to  
Convert  
a Breadboard into a Kinematic Platform

##### Selection Guide

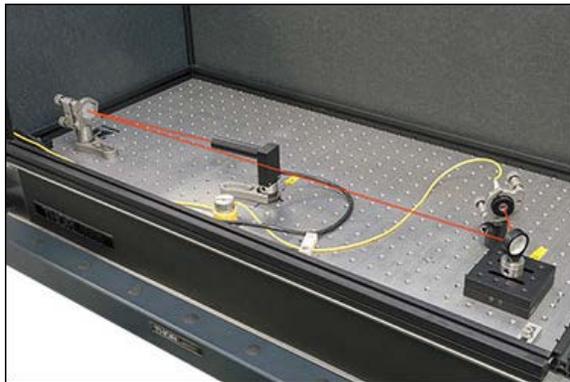
Product Image (Click to Enlarge)							
Item #	KB1X1(M)	KB3X3(M)	KBM1(M)	KBS98	SB1(M)	NX1F(M)	NX1N(M)
Features	Compact	Multiple Mounting Options	Multiple Mounting Options, Locking Magnet	Breadboard Mounting	Locking Magnet	15 Positions	Ø1" Optic Mount, 16 Positions
Tapped Holes	None	Nine 1/4"-20 (M6) Taps	39 1/4"-20 (M6) Taps	N/A	1/4"-20 (M6) Tap	1/4"-20 (M6) Tap	N/A
Counterbores	#8 (M4) Hole	1/4" (M6) Hole	None	12 1/4" (M6) Slots	None	None	N/A
Size	1" x 1" (25 mm x 25 mm)	3" x 3" (75 mm x 75 mm)	3.94" x 3.94" (100 mm x 100 mm)	N/A	Ø1.7" (Ø43 mm)	Ø1.3" (Ø33 mm)	Ø1.3" (Ø33 mm)

[Hide Repeatability](#)

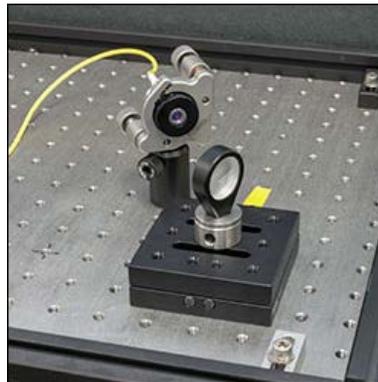
REPEATABILITY

**Repeatability Testing**

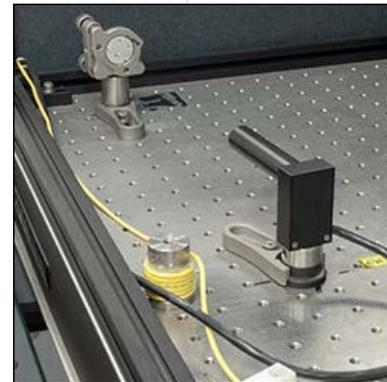
A selection of Thorlabs Kinematic Bases were tested to determine the deviation of a reflected beam attributed to removing and replacing the top plate of the base. The test setup (see photo below and on the left) consisted of an S1FC635 fiber-coupled laser source, terminating in a fiber collimator that was held in a POLARIS-K1 Mirror Mount. The collimated beam was directed towards a BB1-E02 mirror housed in an LMR1 fixed mount that was post mounted on the kinematic base being tested (see photo below and center). After reflecting off the first mirror, the beam traveled towards and reflected off of a second mirror housed in a POLARIS-K1 mount. After reflection, the light was directed onto a PDP90A Lateral Effect Position Sensor that had three SM05L10 SM05-Threaded Lens Tubes attached to the front to block stray light (see photo below and to the right). The total beam path is shown in the first photo and is 1 m long.



[Click to Enlarge](#)



[Click to Enlarge](#)



[Click to Enlarge](#)

The test was conducted by first centering the beam on the sensor through adjustment of the Polaris mount holding the second mirror. After centering the beam, thirty seconds were allowed to pass for stabilization purposes, and then a measurement of the beam position was made and recorded as the initial position. Next, the top plate of the kinematic base was lifted from the bottom and then replaced in the same orientation. After a thirty second stabilization period, a second measurement of the beam position was taken. Finally, the Polaris mirror mount was readjusted to center the beam on the sensor, and the process was repeated. Sixty data points were collected, amounting to thirty measurements of the beam displacement.

The results of the measurements are presented in the table and graphs below as the absolute difference in  $\mu\text{rad}$  between the original position of the beam on the sensor and the position after removing and replacing the top plate of the kinematic base. Each value has been divided by two to account for the reflection off the second mirror. The combined value takes into account both X- and Y-position measurements and represents the net distance of the deviation from the origin.

KB1X1 - Summary of 30 Measurements					
Dimension	Mean	Median	Minimum	Maximum	Plot
$ \Delta X $	2.40 $\mu\text{rad}$	1.20 $\mu\text{rad}$	0.03 $\mu\text{rad}$	26.72 $\mu\text{rad}$	
$ \Delta Y $	4.78 $\mu\text{rad}$	2.04 $\mu\text{rad}$	0.04 $\mu\text{rad}$	21.71 $\mu\text{rad}$	
Combined	6.36 $\mu\text{rad}$	2.95 $\mu\text{rad}$	0.58 $\mu\text{rad}$	26.72 $\mu\text{rad}$	



KB3X3 - Summary of Results					
Dimension	Mean	Median	Minimum	Maximum	Plot
$ \Delta X $	16.71 $\mu\text{rad}$	8.00 $\mu\text{rad}$	0.06 $\mu\text{rad}$	73.54 $\mu\text{rad}$	
$ \Delta Y $	10.47 $\mu\text{rad}$	3.04 $\mu\text{rad}$	0.26 $\mu\text{rad}$	58.63 $\mu\text{rad}$	
Combined	21.20 $\mu\text{rad}$	11.74 $\mu\text{rad}$	1.30 $\mu\text{rad}$	81.90 $\mu\text{rad}$	



SB1 - Summary of Results					
Dimension	Mean	Median	Minimum	Maximum	Plot
$ \Delta X $	9.15 $\mu\text{rad}$	0.64 $\mu\text{rad}$	0.01 $\mu\text{rad}$	159.40 $\mu\text{rad}$	
$ \Delta Y $	3.07 $\mu\text{rad}$	1.71 $\mu\text{rad}$	0.01 $\mu\text{rad}$	17.48 $\mu\text{rad}$	
Combined	11.21 $\mu\text{rad}$	2.31 $\mu\text{rad}$	0.52 $\mu\text{rad}$	159.47 $\mu\text{rad}$	



NX1F - Summary of Results					
Dimension	Mean	Median	Minimum	Maximum	Plot
$ \Delta X $	11.48 $\mu\text{rad}$	0.99 $\mu\text{rad}$	0.02 $\mu\text{rad}$	145.87 $\mu\text{rad}$	
$ \Delta Y $	1.67 $\mu\text{rad}$	1.02 $\mu\text{rad}$	0.01 $\mu\text{rad}$	7.39 $\mu\text{rad}$	
Combined	12.13 $\mu\text{rad}$	1.48 $\mu\text{rad}$	0.48 $\mu\text{rad}$	145.93 $\mu\text{rad}$	



NX1N - Summary of Results					
Dimension	Mean	Median	Minimum	Maximum	Plot
$ \Delta X $	10.05 $\mu\text{rad}$	1.32 $\mu\text{rad}$	0.09 $\mu\text{rad}$	140.45 $\mu\text{rad}$	
$ \Delta Y $	1.30 $\mu\text{rad}$	1.00 $\mu\text{rad}$	0.01 $\mu\text{rad}$	4.27 $\mu\text{rad}$	
Combined	10.6 $\mu\text{rad}$	2.12 $\mu\text{rad}$	0.38 $\mu\text{rad}$	140.50 $\mu\text{rad}$	



[Hide Kinematic Base: 1" x 1" \(25 mm x 25 mm\)](#)

**Kinematic Base: 1" x 1" (25 mm x 25 mm)**



- 30  $\mu$ rad Angular Repeatability
- 30  $\mu$ m Lateral Repeatability
- Ball and V-Groove Design Allows High-Precision Positioning
- KB1X1 (KB25/M) Kinematic Base Includes #8 (M4) Counterbored Top and Bottom Plates
- Top Plate with Four 8-32 (M4) Tapped Holes Available

The top mounting plate and bottom base plate of the KB1X1 (KB25/M) kinematic base are magnetically coupled using two pairs of high-strength magnets. The top plate of the base can be inserted and removed with high repeatability. The top and bottom plate both have a center-located #8 (M4) counterbore hole which allows either plate to be mounted to a  $\varnothing$ 1/2" post. Using an AE8E25E (AE4M6M) thread adapter, the plates can also be secured to a 1/4"-20 (M6) tapped optical table. Alternatively, the KBT1X1T and KBT25T/M top plates feature four 8-32 or M4 tapped holes, respectively (see image to the left). For information about repeatability testing of the KB1X1 and other kinematic bases, see the *Repeatability* tab.



KB1X1 Kinematic Base

Part Number	Description	Price	Availability
KB1X1	Complete 1" x 1" Kinematic Base, Top and Bottom Plates, #8 Counterbores	\$75.60	Today
KBT1X1	Top Plate Only of the KB1X1 Kinematic Base, #8 Counterbore	\$39.90	Today
KBB1X1	Bottom Plate Only of the KB1X1 Kinematic Base, #8 Counterbore	\$39.90	Today
KBT1X1T	Customer Inspired!Top Plate for KBB1X1 Kinematic Bottom Plate, Four 8-32 Taps	\$39.90	Today
KB25/M	Complete 25 mm x 25 mm Kinematic Base, Top and Bottom Plates, M4 Counterbores	\$75.60	Today
KBT25/M	Top Plate Only of the KB25/M Kinematic Base, M4 Counterbore	\$39.90	Today
KBB25/M	Bottom Plate Only of the KB25/M Kinematic Base, M4 Counterbore	\$39.90	Today
KBT25T/M	Customer Inspired!Top Plate for KBB25/M Kinematic Bottom Plate, Four M4 Taps	\$39.90	Today

[Hide Kinematic Base: 3" x 3" \(75 mm x 75 mm\)](#)

### Kinematic Base: 3" x 3" (75 mm x 75 mm)



- 30  $\mu$ m Lateral Repeatability
- Ball and V-Groove Design Allows High-Precision Positioning
- Top Plate Offers Center 1/4" (M6) Counterbore and Nine 1/4"-20 (M6) Tapped Holes
- Top and Bottom Plates Available Individually or as Complete Unit

The top mounting plate and bottom base plate of the KB3X3 kinematic base are magnetically coupled using two pairs of high-strength magnets. With a ball and V-groove design, the top plate can be inserted and removed with high repeatability. The top plate has a central 1/4" (M6) through hole that can be used to attach a  $\varnothing$ 1/2" post holder, while an array of nine 1/4"-20 (M6) tapped holes on the top plate provide the same mounting functionality as an optical breadboard. As seen in the image to the left, the top plate of the KB3X3 is engraved with a triangle indicating the high-load mounting region. Individual top and bottom plates are also available for interchanging different optomechanical setups.



Click to Enlarge POLARIS-K2F1 Mirror Mount on KB3X3 Base



Click to Enlarge KB3X3 Kinematic Base

For information about testing done on the repeatability of the KB3X3 and other kinematic bases, please see the *Repeatability* tab.

Part Number	Description	Price	Availability
KB3X3	Complete 3" x 3" Kinematic Base, Top and Bottom Plates	\$90.40	Today
KBT3X3	Top Plate Only of the KB3X3 Kinematic Base	\$48.30	Today
KBB3X3	Bottom Plate Only of the KB3X3 Kinematic Base	\$48.30	Today
KB75/M	Complete 75 mm x 75 mm Kinematic Base, Top and Bottom Plates, Metric	\$90.40	Today
KBT75/M	Top Plate Only of the KB75/M Kinematic Base, Metric	\$48.30	Today
KBB75/M	Bottom Plate Only of the KB75/M Kinematic Base, Metric	\$48.30	Today

[Hide Lockable Kinematic Breadboard: 3.94" x 3.94" \(100 mm x 100 mm\)](#)

### Lockable Kinematic Breadboard: 3.94" x 3.94" (100 mm x 100 mm)



- 30  $\mu$ m Lateral Repeatability
- Magnetic Holding Force of 75 N (16.8 lbs)
- Ball and V-Groove Design Allows High-Precision Positioning
- Top Plate Offers 39 1/4"-20 (M6) Tapped Holes for Mounting
- Top and Bottom Plates Available Individually or as Complete Unit



Click to Enlarge  
FiberBench Mounted on KBM1 Base



Click to Enlarge  
KBM1 Kinematic Breadboard

The KBM1(/M) is a compact, high-precision, low-profile, lockable kinematic magnetic base, measuring 3.94" x 3.94" x 0.98" (100.0 mm x 100.0 mm x 25.0 mm). The top mounting plate and bottom base plate of the KBM1(/M) kinematic base (see photo to the far right) are magnetically coupled using a high-strength magnet. With a ball and V-groove design, the top plate can be removed and replaced with a

lateral repeatability of 30  $\mu$ m. The high repeatability of the unit allows minimal readjustment of the setup for applications where frequent removal and insertion of components is needed. Individual top and bottom plates are also available for interchanging different optomechanical setups.

The top plate has an array of 39 1/4"-20 (M6) tapped holes [0.46" (11.8 mm) deep] spaced 0.5" (12.5 mm) apart and provides the same mounting functionality as an optical breadboard. The bottom plate has two 2.00" (50.0 mm) long counterbored slots for 1/4"-20 (M6) cap screws for mounting to an optical table. The magnetic force between the two plates is switched on and off by turning the switching screw through 90° using a 3/16" (5 mm) hex wrench. The magnetic switch design allows for the top plate to be mounted with less risk of damage or misalignment to precision components and fragile payloads.

Please note that the switch in the base should be set to off before placing the top to avoid damaging the kinematic seats. The switch can be engaged once the top has been installed. Maximum stability in the top plate can be achieved by keeping the center of mass of optomechanics mounted on the plate within the triangular region between the kinematic seats (see photos above).

The photo to the upper right shows the KBM1 being used with our FT-38X135 FiberBench. The FiberBench system is designed to couple fiber optic setups into free space and facilitates the quick exchange, insertion, or removal of optical components while maintaining the same optical axis.

Part Number	Description	Price	Availability
KBM1	Complete, Switchable Magnetic Kinematic Breadboard, 1/4"-20 Taps	\$286.00	3-5 Days
KBM1T	Top Plate Only of the KMB1 Kinematic Breadboard, 1/4"-20 Taps	\$107.00	Lead Time
KBM1B	Bottom Plate Only of the KMB1 Kinematic Breadboard	\$179.00	Lead Time
KBM1/M	Complete, Switchable Magnetic Kinematic Breadboard, M6 Taps	\$286.00	3-5 Days
KBM1T/M	Top Plate Only of the KMB1/M Kinematic Breadboard, M6 Taps	\$107.00	Lead Time
KBM1B/M	Bottom Plate Only of the KMB1/M Kinematic Breadboard	\$179.00	3-5 Days

[Hide Kinematic Breadboard Seats](#)

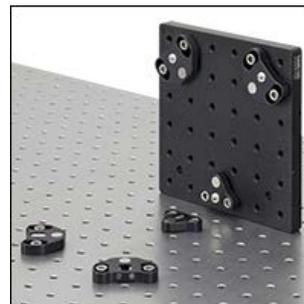
### Kinematic Breadboard Seats



- Converts Any Breadboard into Kinematic Platform
- Ball and V-Groove Design Allows High-Precision Positioning
- Seats Offer Universal 1/4" (M6) Counterbores for Breadboard Mounting
- Top and Bottom Plate Sets Available Individually or as Complete Unit

The KBS98 kinematic seats can be used to convert any imperial or metric breadboard into a kinematic platform that can be removed and replaced with a high degree of accuracy. The KBS98 consists of six plates. Three of the plates, which are referred to as the bottom set, have V-groove slots and should be mounted on the stationary optical table or breadboard. The other three plates, which are referred to as the top set, have an inset ball that will sit in the V-groove of the bottom plate.

The top plates should be attached to the optical breadboard that is being taken out of and put back into an optical setup. The seats should be arranged in a triangular pattern near the corners/edge of the optical breadboard with the V-grooves in the bottom plates aligned so that the three axes defined by the V-grooves



intersect at a common point. Proper positioning of the plates is necessary in order to maximize the stability of the optical breadboard.

Click to Enlarge  
KBS98 Kinematic Seats Can Be Used to  
Convert  
a Breadboard into a Kinematic Platform

Part Number	Description	Price	Availability
KBS98	Complete, Kinematic Breadboard Seats, 6 Pieces	\$134.00	Today
KBS98T	Top Seats Only of the KBS98 Kinematic Breadboard Seats, 3 Pieces	\$67.20	Today
KBS98B	Customer Inspired!Bottom Seats Only of the KBS98 Kinematic Breadboard Seats, 3 Pieces	\$71.40	Today

[Hide Round Kinematic Base: Ø1.70" \(Ø43.2 mm\)](#)

### Round Kinematic Base: Ø1.70" (Ø43.2 mm)



- 1 µrad Repeatability
- On/Off Switch to Connect/Disconnect Plates
- SB1(M) Includes 1/4"-20 (M6) Tapped Top Plate and 1/4" (M6) Counterbored Bottom Plate
- Top Plate with Centered 8-32 Tap Available

The top plate of this compact kinematic base can be easily removed and replaced with an ON/OFF switch that interrupts the magnetic force coupling the plates of the base. With a ball and V-groove design, the top plate will automatically reposition to an exact location with a repeatability of 1 µrad. The bottom plate has a centered 1/4"-20 (M6) through hole counterbored for a caphead screw that allows the base to be mounted to an optical table. Alternatively, CL6 table clamps can be used in the groove of the bottom plate to fix the base in an arbitrary position on an optical table, as shown in the photo to the right. For information about testing done on the repeatability of the SB1 and other kinematic bases, please see the *Repeatability* tab.



Click to Enlarge

Please note that the universal SB1B bottom plate shipped with SB1(M) kinematic bases is compatible with any of the four replacement or alternative top plates below.

Part Number	Description	Price	Availability
SB1	Complete Round Kinematic Base, 1/4"-20 Tap	\$95.60	Today
SB1T	Top Plate Only of the SB1 Round Kinematic Base, 1/4"-20 Tap	\$62.00	Today
SB1B	Bottom Plate Only of the SB1 and SB1/M Round Kinematic Bases	\$44.10	Today
SB1T8	Customer Inspired!Top Plate Only for the SB1B Kinematic Base, 8-32 Tap	\$61.90	Today
SB1/M	Complete Round Kinematic Base, M6 Tap	\$95.60	Today
SB1T/M	Top Plate only of the SB1/M Round Kinematic Base, M6 Tap	\$62.00	Today
SB1T4/M	Customer Inspired!Top Plate Only for the SB1B Kinematic Base, M4 Tap	\$61.90	Today

[Hide Indexing Mounting Base](#)

### Indexing Mounting Base



#### Features

- 10 µrad Repeatability
- Indexes to 15 Positions
- 8-32 (M4) Center Tapped Hole

#### Applications

- Precise Switching of Shared Laser Systems
- Directing Optical Systems to Multiple Test Instruments
- Easy Exchange of Optical Components

see the *Repeatability* tab.

The NX1F is a 15-position indexing kinematic base that is ideal for redirecting a laser to multiple targets on an optical table. Each indexed position is labeled, and the top plate returns to any given position with a repeatability of 10 µrad. Three 8-32 (M4) tapped mounting holes in the bottom plate can be used to secure the NX1F to a Ø1/2" post.

The bottom plate can be secured to a 1/4"-20 (M6) tapped optical table or breadboard with the use of an AP8E25E (AP6M4M) adapter. For information about testing done on the repeatability of the NX1F and other kinematic bases, please



Click to Enlarge  
The top and bottom panels of the NX1F  
Indexing Mounting Base

Part Number	Description	Price	Availability
NX1F	Complete, 15-Position Indexing Base, Top and Bottom Plates, 8-32 Taps	\$86.20	Today
NX1F/M	Complete, 15-Position Indexing Base, Top and Bottom Plates, M4 Taps	\$86.20	Today

[Hide Indexing Mount for Ø1" Optics](#)

### Indexing Mount for Ø1" Optics



- Indexed with 16 Positions at 22.5° Increments
- Holds Ø1" Optics up to 7 mm (0.27") Thick
- <10 µrad Repeatability
- Three 8-32 (M4) Mounting Holes in Bottom Plate
- Easy, Repeatable Exchange of Optical Components

The NX1N(/M) indexing mount for Ø1" optics features 16 indexed positions every 22.5° allowing the optic to be held at both 45° and 90°. The angular positions are engraved on the base plate for fast alignment. The top plate returns to any given position, indicated with an engraved witness line, with a repeatability of better than 10 µrad. This mount is ideal for redirecting a laser to multiple targets on an optical table, as well as for precise switching of shared laser systems.



Click to Enlarge

The NX1N(/M) Indexing Mount can hold an optic at any one of 16 positions including 45° and 90°.

The included SM1 (1.035"-40) retaining ring (SM1RR) secures the optic against the front lip of the mount. This indexing mount can hold optics that are no greater than 7 mm (0.27") thick. Neodymium iron magnets couple the top and bottom plates while stainless steel ball bearings and V-grooves provide the 16 indexing positions. Three 8-32 (M4) tapped mounting holes in the bottom plate allow the mount to be secured to a Ø1/2" post. A small through hole, located directly under the 90° engraving on the bottom plate, accepts a 5/64" (2.00 mm) ball driver to help provide enough torque when attaching the mount to the post. For information about testing done on the repeatability of the NX1N and other kinematic bases, please see the *Repeatability* tab.

Please Note: The top plate of this indexing mount is not compatible with the NX1F(/M) 15-position, indexing mounting base (sold separately).

Part Number	Description	Price	Availability
NX1N	Customer Inspired!16-Position Indexing Mount for Ø1" Optics, 8-32 Taps	\$107.00	Today
NX1N/M	Customer Inspired!16-Position Indexing Mount for Ø1" Optics, M4 Taps	\$107.00	Today

Visit the *Kinematic Bases* page for pricing and availability information:  
[http://www.thorlabs.com/newgrouppage9.cfm?objectgroup\\_id=1546](http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=1546)