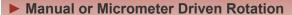56 Sparta Avenue • Newton, New Jersey 07860
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THORLABS

CRM1P - July 26, 2021

Item # CRM1P was discontinued on July 26, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

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30 mm CAGE SYSTEM ROTATION MOUNTS FOR Ø1" OR Ø25.0 mm OPTICS

► **Manual or Micrometer Driven Rotation**
► **SM1 Threaded or Double Bored with Setscrews**
► **Lockable, 360° of Continuous Rotation**

Application Idea

2° Dial Graduations
Labeled Every 20°

Double Bored
with Setscrew

CRM1LT

SM1 Threaded

CRM1T

±7° of
Precision
Micrometer
Adjustment

CRM1P

CRM1PM

OVERVIEW

Features

- Accepts Ø1" or Ø25.0 mm Optics
- 360° Coarse Rotation, Lockable
- Precise Positioning of Wave Plates, Polarizers, and Other Polarization Optics
- 2° Graduations on Dial, Labeled Every 20°
- Compatible with Thorlabs 30 mm Cage System
- Post Mountable

Alternative Size Options
16 mm Cage Rotation Mounts
30 mm Cage Rotation Mounts
60 mm Cage Rotation Mounts

Our 30 mm cage system rotation mounts provide 360° of continuous rotation with a locking screw to fix the position of the mount once the optic has been aligned. The smooth adjustment mechanism allows for precise positioning of a variety of optics. An 8-32 (M4) threaded hole on the bottom of each rotation mount allows it to be mounted on a TR series post.

These rotation mounts are designed to accept Ø1" (Ø25.4 mm) optics. They are also mechanically compatible with Ø25.0 mm optics, but we only recommend this for applications in which the centration of the optics is not critical. The CRM1T(/M) and CRM1P(/M) have an SM1 (1.035"-40) internally threaded central hole and each include an SM1RR retaining ring. Alternatively, the CRM1LT(/M) has a double-bored central hole where the optic is retained using a setscrew.

Thorlabs also offers prism mounts that are compatible with the CRM1T rotation mounts. The K6A1(/M) is a compact platform that comes with a clamping arm and mounting screws, thus allowing the user to easily mount prisms to the rotation mount. The SM1PM10 and SM1PM15 are designed to mount our polarizing prisms and feature an external SM1 threading (see below for more details). For our complete selection of rotation mounts and stages, please see the *Rotation Mounts and Stages* tab.

CAGE OVERVIEW

Cage System Overview

The Cage Assembly System provides a convenient way to construct large optomechanical systems with an established line of precision-machined building blocks designed for high flexibility and accurate alignment.

16 mm, 30 mm, and 60 mm Cage System Standards

Thorlabs offers three standards defined by the center-to-center spacing of the cage assembly rods (see image below). The 16 mm cage, 30 mm cage, and 60 mm cage standards are designed to accomodate Ø1/2", Ø1", and Ø2" optics, respectively. Specialized cage plates that allow smaller optics to be directly inserted into our larger cage systems are also available.

Standard Threads

The flexibility of our Cage Assembly System stems from well-defined mounting and thread standards designed to directly interface with a wide range of specialized products. The three most prevalent thread standards are our SM05 Series (0.535"-40 thread), SM1 Series (1.035"-40 thread), and SM2 Series (2.035"-40 thread), all of which were defined to house the industry's most common optic sizes. Essential building blocks, such as our popular lens tubes, directly interface to these standards.

An example of the standard cage plate measurements determining cage system compatibility.

Standard Cage System Measurements			
Cage System	**16 mm**	**30 mm**	**60 mm**
Thread Series	SM05	SM1	SM2
Rod to Rod Spacing	16 mm (0.63")	30 mm (1.18")	60 mm (2.36")
Total Length	25 mm (0.98")	41 mm (1.60")	71.1 mm (2.8")

Cage Components		
Cage Rods	16 mm	These rods are used to connect cage plates, optic mounts, and other components in the cage system. The SR Series Cage Rods are compatible with our 16 mm cage systems, while the 30 mm and 60 mm cage systems use ER Series Cage Rods.
	30 mm	
	60 mm	
Cage Plates	16 mm	These serve as the basic building blocks for a cage system. They may have SM-threaded central bores, smooth bores sized for industry standard optics or to accommodate the outer profile of our SM Series Lens Tubes, or specialized bores for other components such as our FiberPorts.
	30 mm	
	60 mm	
Optic Mounts	16 mm	Thorlabs offers fixed, kinematic, rotation, and translation mounts specifically designed for our Cage Systems.
	30 mm	
	60 mm	
Cage Cubes	16 mm	These cubes are useful for housing larger optical components, such as prisms or mirrors, or optics that need to sit at an angle to the beam path, such as beamsplitters. Our cage cubes are available empty or with pre-mounted optics.
	30 mm	
	60 mm	
Post and Breadboard Mounts and Adapters		Mounting options for cage systems can be found on our Cage System Construction pages. Cage Systems can be mounted either parallel or perpendicular to the table surface.
Size Adapters		Cage System Size Adapters can be used to integrate components from different cage system and threading standards.
Specialized Components		Thorlabs also produces specialized cage components, such as Filter Wheels, a HeNe Laser Mount, and a FiberPort Cage Plate Adapter, allowing a wide range of our products to be integrated into cage-mounted optical systems. Explore our Cage Systems Visual Navigation Guide to see the full range of Thorlabs' cage components.

VERNIER SCALES

Reading a Vernier Scale

Vernier scales are typically used to add precision to standard, evenly divided scales (such as the scale on Thorlabs' rotation mounts). A vernier scale has found common use in many precision measurement tools, the most common being calipers and micrometers. The direct vernier scale uses two scales side-by-side: the main scale and the vernier scale. The vernier scale has a slightly smaller spacing between its tick marks (10% smaller than the main). Hence, the lines on the main scale will not line up with all the lines on the vernier scale. Only one line from the vernier scale will match well with one line of the main scale, and that is the trick to reading a vernier scale.

Figures 1 through 3 show a vernier scale system for three different situations. In each case, the scale on the left is the main scale, while the small scale on the right is the vernier scale. When reading a vernier scale, the main scale is used for the gross number, and the vernier scale gives the precision value. In this manner, a standard ruler or micrometer can become a precision tool.

The 0 on the vernier scale is the "pointer" (marked by a red arrow in Figs. 1 - 3) and will indicate the main scale reading. In Figure 1 we see the pointer is lined up directly with the 75.6 line. Notice that the only other vernier scale tick mark that lines up well with the main scale is 10. Since the vernier 0 lines up with the main scale's 75.6, the reading from Figure 1 is 75.60 (in whatever units the tool measures in).
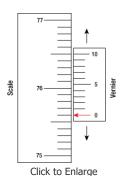
That is essentially all there is to reading a vernier scale. It's a very straightforward way of increasing the precision of a measurement tool. To expound, let's look at Figure 2. Here we see that the pointer is no longer aligned with a scale line, instead it is slightly above 75.6, but below 75.7; thus the gross measurement is 75.6. The first vernier line that coincides with a main scale line is the 5, shown with a blue arrow. The vernier scale gives the final digit of precision; since the 5 is aligned to the main scale, the precision measurement for Figure 2 is 75.65.

Since the vernier scale is 10% smaller than the main scale, moving 1/10 of the main scale will align the next vernier marking. This asks the obvious question: what if the measurement is within the 1/10 precision of the vernier scale? Figure 3 shows just this. Again, the pointer line is in between 75.6 and 75.7, yielding the gross measurement of 75.6. If we look closely, we see that the vernier 7 (marked with a blue arrow) is very closely aligned to the main scale, giving a precision measurement of 75.67. However, the vernier 7 is very slightly above the main scale mark, and we can see that the vernier 8 (directly above 7) is slightly below its corresponding main scale mark. Hence, the scale on Figure 3 could be read as 75.673 ± 0.002. A reading error of about 0.002 would be appropriate for this tool.

As we've seen here, vernier scales add precision to a standard scale measurement. While it takes a bit of getting used to, with a little practice, reading these scales is fairly straightforward. All vernier scales, direct or retrograde, are read in the same fashion.
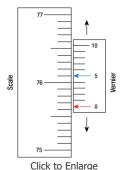

Click to Enlarge
Figure 1: An example of how to read a vernier scale. The red arrow indicates what is known as the pointer. Since the tick mark labeled 10 on the vernier scale aligns with one of the tick marks on the main scale, this vernier scale is reading 75.60 (in whatever units the tool measures).

Click to Enlarge
Figure 2: An Example of a vernier scale. The red arrow indicates the pointer and the blue arrow indicates the vernier line that matches the main scale. This scale reads 75.65.

Click to Enlarge
Figure 3: An Example of a vernier scale. The red arrow indicates the pointer and the blue arrow indicates the vernier line that matches the main scale. This scale reads 75.67, but can be accurately read as 75.673 ± 0.002.
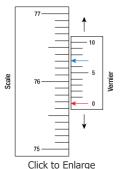
Rotation Mount and Stage Selection Guide

Thorlabs offers a wide variety of manual and motorized rotation mounts and stages. Rotation mounts are designed with an inner bore to mount a Ø1/2", Ø1", or Ø2" optic, while rotation stages are designed with mounting taps to attach a variety of components or systems. Motorized options are powered by a DC Servo motor, 2 phase stepper motor, piezo inertia motor, or an Elliptec™ resonant piezo motor. Each offers 360° of continuous rotation.

Manual Rotation Mounts

Rotation Mounts for Ø1/2" Optics							
Item #	MRM05(/M)	RSP05(/M)	CRM05	PRM05(/M)[a]	SRM05	KS05RS	CT104
Click Photo to Enlarge							
Features	Mini Series	Standard	External SM1 (1.035"-40) Threads	Micrometer	16 mm Cage-Compatible	±4° Kinematic Tip/Tilt Adjustment Plus Rotation	Compatible with CT1 Cage Translator Stage and 1/4" Translation Stages[b]
Additional Details							More [+]

a. This mount is available in the PRM05GL5 bundle, which includes the PRM05 rotation mount with the SM05PM5 polarizing prism mount.
b. The CT104 is complatible with the 1/4" translation stages using our MS103(/M) adapter plate.
c. The CT104 is compatible with the CT1 cage translation stage, which is designed for use with 30 mm cage systems.

Rotation Mounts for Ø1" Optics							
Item #	RSP1(/M)	LRM1	RSP1D(/M)	DLM1(/M)	CLR1(/M)	RSP1X15(/M)	RSP1X225(/M)	PRM1(/M)[a]
Click Photo to Enlarge								
Features	Standard	External SM1 (1.035"-40) Threads	Adjustable Zero	Two Independently Rotating Carriages	Rotates Optic Within Fixed Lens Tube System	Continuous 360° Rotation or 15° Increments	Continuous 360° Rotation or 22.5° Increments	Micrometer
Additional Details								More [+]

a. This mount is available in the PRM1GL10 bundle, which includes the PRM1 rotation mount with the SM1PM10 polarizing prism mount.

Rotation Mounts for Ø1" Optics					
Item #	LM1-A & LM1-B(/M)	CRM1(/M)	CRM1L(/M)	CRM1P	KS1RS	K6XS
Click Photo to Enlarge					
Features	Optic Carriage Rotates Within Mounting Ring	30 mm Cage-Compatible[a]	30 mm Cage-Compatible for Thick Optics[a]	30 mm Cage-Compatible with Micrometer[a]	±4° Kinematic Tip/Tilt Adjustment Plus Rotation	Six-Axis Kinematic Mount[a]
Additional Details						More [+]

a. This mount also features four 4-40 (M3) holes on the rotation dial for use with the K6A1(/M) prism platform.

Rotation Mounts for Ø2" Optics						
Item #	RSP2(/M)	RSP2D(/M)	PRM2(/M)	LM2-A & LM2-B(/M)	LCRM2(/M)	KS2RS	K6X2
Click Photo to Enlarge							
Features	Standard	Adjustable Zero	Micrometer	Optic Carriage Rotates Within Mounting Ring	60 mm Cage-Compatible	±4° Kinematic Tip/Tilt Adjustment Plus Rotation	Six-Axis Kinematic Mount
Additional Details							More [+]

Manual Rotation Stages

Manual Rotation Stages						
Item #	RP005(/M)	PR005(/M)	MSRP01(/M)	RP01(/M)	RP03(/M)	QRP02(/M)
Click Photo to Enlarge						
Features	Standard					Two Hard Stops
Additional Details						More [+]

Manual Rotation Stages						
Item #	XRNR1(/M)	XRR1(/M)	PR01(/M)	CR1(/M)	XYR1(/M)	OCT-XYR1(/M)
Click Photo to Enlarge						
Features	Fine Rotation Adjuster and 2" Wide Dovetail Quick Connect	Fine Rotation Adjuster and 3" Wide Dovetail Quick Connect	Fine Rotation Adjuster and SM1-Threaded Central Aperture	Fine Pitch Worm Gear	Rotation and 1/2" Linear XY Translation	
Additional Details						Less [-]

    a. The stage profile is higher when it is mounted using the screw slots rather than stacked on another stage or accessory with mating dovetails.

    b. The OCT-XYR1(/M) stage includes the XYR1A solid sample plate. This plate can be detached from the stage to reveal the same mounting features present on the XYR1(/M) stage.

Motorized Rotation Mounts and Stages

Motorized Rotation Mounts and Stages with Central Clear Apertures						
Item #	DDR25(/M)	PDR1(/M)	K10CR1(/M)	PRM1Z8(/M)[a]	DDR100(/M)	ELL14	HDR50(/M)
Click Photo to Enlarge							
Features	Compatible with SM05 Lens Tubes, 16 mm Cage System, 30 mm Cage System	Compatible with SM05 Lens Tubes, 30 mm Cage System, PD1(/M) and PDX1(/M) Linear Stages	Compatible with SM1 Lens Tubes & 30 mm Cage System		Compatible with SM1 Lens Tubes, 16 mm Cage System, 30 mm Cage System	Compatible with SM1 Lens Tubes, Open Frame Design for OEM Applications	Compatible with SM2 Lens Tubes
Additional Details							More [+]

    a. This stage is available in the KPRMTE(/M), which includes the PRMTZ8(/M) Motorized Rotation Stage with the KDC101 K-Cube DC Servo Motor Controller.

Motorized Rotation Mounts and Stages with Tapped Platforms		
Item #	PRMTZ8(/M)[a]	ELL18(/M)[b]
Click Photo to Enlarge		
Features	Tapped Mounting Platform for Mounting Prisms or Other Optics	Tapped Mounting Platform, Open Frame Design for OEM Applications
Additional Details		More [+]

    a. This stage is available in the KPRM1E(/M), which includes the PRMT1Z8(/M) Motorized Rotation Stage with the KDC101 K-Cube DC Servo Motor Controller.

    b. This stage is available in the ELL18K(/M), which includes an interface board, mounting brackets, and connectors for PC control.

Cage Rotation Mount, Ø1" (Ø25.4 mm) or Ø25.0 mm Optics

- ▶ 360° of Continuous Rotation, Lockable
- ▶ 2° Graduations on Dial, Labeled Every 20°
- ▶ Accepts Ø1" (Ø25.4 mm) or Ø25.0 mm Optics
- ▶ CRM1T(/M) Maximum Optic Thickness: 0.37" (9.4 mm)
- ▶ CRM1LT(/M) Minimum Optic Thickness: 0.31" (7.9 mm)
- ▶ 8-32 (M4) Tapped Mounting Hole to Mount on TR Series Posts

The CRM1T(/M) and CRM1LT(/M) have a smooth rotation mechanism that allows for precise positioning of the rotation carriage and the mounts are compatible with the 30 mm cage system.

The CRM1T(/M) is designed to mount Ø1" (Ø25.4 mm) optics up to 0.37" (9.4 mm) thick in an SM1-threaded rotation carriage. The optic is secured using the included SM1RR retaining ring (the SPW602 spanner wrench is ideal for tightening this retaining ring). For thicker optics, any of our SM1 series of lens tubes can be threaded into the carriage or the CRM1LT can be used instead. The CRM1LT(/M) is designed to mount Ø1" (Ø25.4 mm) optics with a minimum thickness of 0.31" (7.9 mm), but unlike the CRM1T, the optic is retained in a double-bored rotation carriage using a setscrew.

These mounts are also mechanically compatible with Ø25.0 mm optics, but we only recommend this for applications in which the centration of the optics is not critical.

Part Number	Description	Price	Availability
CRM1T/M	**NEW! Cage Rotation Mount for Ø1" Optics, SM1 Threaded, M4 Tap**	$87.39	**Lead Time**
CRM1LT/M	**NEW! Cage Rotation Mount for Ø1" Optics, Double Bored with Setscrew, M4 Tap**	$99.29	**Today**
CRM1T	**NEW! Cage Rotation Mount for Ø1" Optics, SM1 Threaded, 8-32 Tap**	$87.39	**5-8 Days**
CRM1LT	**NEW! Cage Rotation Mount for Ø1" Optics, Double Bored with Setscrew, 8-32 Tap**	$99.29	**Today**

Precision 30 mm Cage Rotation Mount, Ø1" (Ø25.4 mm) or Ø25 mm Optics

- ▶ 360° Coarse Rotation, Lockable
- ▶ 2° Graduations on Dial, Labeled Every 20°
- ▶ ±7° Precision Micrometer Adjustment
- ▶ Vernier Scale Provides 5 arcmin Resolution
- ▶ Accepts Ø1" (Ø25.4 mm) or Ø25.0 mm Optics up to 0.37" (9.4 mm) Thick
- ▶ 8-32 (M4) Tapped Mounting Hole to Mount on TR Series Posts

This animation shows the manual rotation and micrometer engagement of the CRM1P.

The CRM1P(/M) is designed to mount Ø1" (Ø25.4 mm) optics up to 9.4 mm thick in an SM1 threaded rotation carriage. The optic is secured using the included SM1RR retaining ring (the SPW602 spanner wrench is ideal for tightening this retaining ring). For thicker optics, any of our SM1 series of lens tubes can be threaded into the carriage. The smooth rotation mechanism on the CRM1P(/M) can be manually rotated to any position. When the rotation carriage is locked, the high-precision, backlash-free micrometer can then be used to fine tune the position of the rotation carriage over a range ±7°. The animation to the right illustrates how the CRM1P(/M) is used. The Vernier scale provides a resolution of 5 arcmin between consecutive marks. As the mount is rotated across the entire Vernier scale, there is a cumulative error of up to ±12.28 arcmin. The CRM1P(/M) is compatible with the 30 mm cage system and the 8-32 (M4) tapped mounting hole allows the rotation mount to be secured on a TR series post.

This mount is also mechanically compatible with Ø25.0 mm optics, but we only recommend this for applications in which the centration of the optics is not critical.

Part Number	Description	Price	Availability
CRM1P/M	Precision Cage Rotation Mount with Micrometer Drive, Ø1" Optics, M4 Tap	$218.59	Lead Time
CRM1P	Precision Cage Rotation Mount with Micrometer Drive, Ø1" Optics, 8-32 Tap	$218.59	Lead Time

Rotation Mount Accessories

The K6A1(/M) is a 0.5" x 1.44" platform designed to be mounted on the rotation ring of the CRM1T(/M), CRM1LT(/M), and CRM1P(/M) 30 mm cage compatible rotation mounts featured above and the K6X six-axis kinematic mount. The K6A1 comes with a PM3 Small Clamping Arm (K6A1/M comes with PM3/M), hex key, and mounting screws. The K6A1 and K6A1/M have 6-32 and M4 x 0.7 tapped holes, respectively, on the mounting platform to secure the supplied clamping arm.

While using the K6A1(/M), the rotation mount needs to be the terminal element on the cage rods because the cage system is not large enough to allow for the

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rotation of the platform. If the rotation mount needs to be an interior cage component, consider building a 60 mm cage system frame around the rotation mount using two LCP02 cage plate adapters as shown in the image to the right. This will allow the platform to be rotated freely without interference from the cage rods while preserving the optical axis of the 30 mm cage system.

The SM1PM10 and SM1PM15 prism mounts are designed to accommodate the popular Glan-Taylor and Glan-Laser Polarizing Calcite Prisms. Their SM1 threading makes them compatible with the CRM1T(/M) and CRM1P(/M) rotation mounts. The rotating cover allows the user to block the two side ports of the calcite prism when they are not required. To load a prims, unthread the prism cover, insert the prism, and tighten the setscrew. When mounting the SPM1PM10 or SPM1PM15 onto a rotation mount, first thread a retaining ring into the rotation mount to a depth of 3/16" (4.8 mm) and then thread on and tighten the prism mount. This will leave room so that the prism cover can rotate freely.

Part Number	Description	Price	Availability
K6A1/M	Prism Mount Accessory for K6XS 6-Axis Mount, Metric	$47.35	Today
SM1PM10	SM1 Lens Tube Mount for 8 mm and 10 mm Mounted Polarizing Prisms	$55.73	5-8 Days
SM1PM15	SM1 Lens Tube Mount for 15 mm Mounted Polarizing Prisms	$67.37	Today
K6A1	Prism Mount Accessory for K6XS 6-Axis Mount, Imperial	$47.35	Today