

LOM1200 - February 28, 2018

Item # LOM1200 was discontinued on February 28, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

OBJECTIVE AND CONDENSER MOUNTING FOR DIY CERNA® SYSTEMS

- ▶ Variety of Threads and Dovetails for Objective & Condenser Mounting
- ▶ Focusing Modules with 1" Travel Range
- ▶ Piezo Objective Scanner for High-Speed Z-Stack Acquisition



CSA1100
Single-Objective Holder



PFM450E
Piezo Objective Scanner



ZFM1030
Manual Focusing
Module



BSA2000
Condenser Holder



ZFM2020
Motorized Focusing
Module



OVERVIEW

Features

- Place Objectives, Condensers, & Macro Lenses at 7.74" Throat Depth of DIY Cerna® Systems
- Objective Nosepieces for M32 x 0.75, M25 x 0.75, or RMS (0.800"-36) Objective Threads
- Piezo Objective Scanner for High-Frame-Rate Z-Stack Acquisition
 - Adapters Add Compatibility with SM1 (1.035"-40) and M26 x 0.706 Threads
- Macro Lens / Condenser Arm with Internal SM2 (2.035"-40) Threads
- Condenser Arms with Female D3N Dovetail for Nikon Condensers
- 60 mm Cage System Compatibility on Select Nosepieces
- Focusing Modules with 1" of Z Travel
 - Motorized Modules for Fine Adjustment
 - Manual Modules for Coarse Adjustment of Condensers
- Dovetail Adapters to Attach DIY Setups to a Condenser Holder or Condenser

Share Your Work With Us!

Have you built a unique setup using DIY Cerna components? Send a picture to ImagingTechSupport@thorlabs.com! Our customers often inform our engineering efforts and inspire us to make new products and improvements for the entire community. We'd love to hear from you.

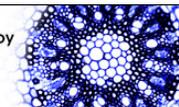


Click to Enlarge
This system uses our CSA1100 Objective Nosepiece, CSA2000 Condenser Arm, and two ZFM2020 modules to mount and motorize an objective and condenser.

Thorlabs' selection of objective and condenser holders provides a variety of mechanical interfaces for mounting objectives, condensers, macro lenses, and other optical elements along the optical path of a DIY Cerna system. For objectives, we offer nosepieces that support M32 x 0.75, M25 x 0.75, and RMS (0.800"-36) objective threads. For condensers, we

Cerna
Microscopy
Platform

PDF





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Our nosepieces and arms contain six M4 counterbores for mounting them to our focusing modules.

offer arms with female D3N dovetails; D3N is Thorlabs' designation for the dovetail used by the majority of Nikon condensers for upright microscopes (see the *Microscope Dovetails* tab for details). In addition, we manufacture a nosepiece with internal SM2 (2.035"-40) threads and taps for 60 mm cage systems, which can be used to mount macro lenses and a wide variety of Thorlabs optomechanics.

Thorlabs also offers focusing modules, which provide 1" of travel along the Z axis. Manual focusing modules are available for condenser holders needing only coarse adjustment. For fine focusing adjustment, both objective and condenser nosepieces and arms connect to the microscope body via our motorized focusing modules. For optics that do not require frequent adjustment, we also offer fixed mounting arms that mount lens tubes and cage systems directly along the optical path of the microscope.

This page also contains two dovetail adapters for home-built setups; the CSA2001 can connect a condenser to a SM2 lens tube system, while the LCPN1 can connect a condenser holder to a SM30 lens tube system or a 30 mm or 60 mm cage system.

MICROSCOPE DOVETAILS

Introduction to Microscope Dovetails

Dovetails are used for mechanical mating and optical port alignment of microscope components. Components are connected by inserting one dovetail into another, then tightening one or more locking setscrews on the female dovetail. Dovetails come in two shapes: linear and circular. Linear dovetails allow the mating components to slide before being locked down, providing flexible positioning options while limiting unneeded degrees of freedom. Circular dovetails align optical ports on different components, maintaining a single optical axis with minimal user intervention.



Click to Enlarge
This photo shows the male 95 mm dovetail on the microscope body and the female 95 mm dovetail on the CSA1002 Fixed Arm.



Click to Enlarge
This photo shows the male D1N dovetail on the trinoculars next to the female D1N dovetail on the epi-illumination arm.

Thorlabs manufactures many components which use dovetails to mate with our own components or those of other manufacturers. To make it easier to identify dovetail compatibility, we have developed a set of dovetail designations. The naming convention of these designations is used only by Thorlabs and not other microscope manufacturers. The table to the right lists all the dovetails Thorlabs makes, along with their key dimensions.

In the case of Thorlabs' Cerna[®] microscopes, different dovetail types are used on different sections of the microscope to ensure that only compatible components can be mated. For example, our WFA2002 Epi-Illuminator Module has a male D1N dovetail that mates with the female D1N dovetail on the microscope body's epi-illumination arm, while the CSS2001 XY Microscopy Stage has a female D1Y dovetail that mates with the male D1Y dovetail on the CSA1051 Mounting Arm.

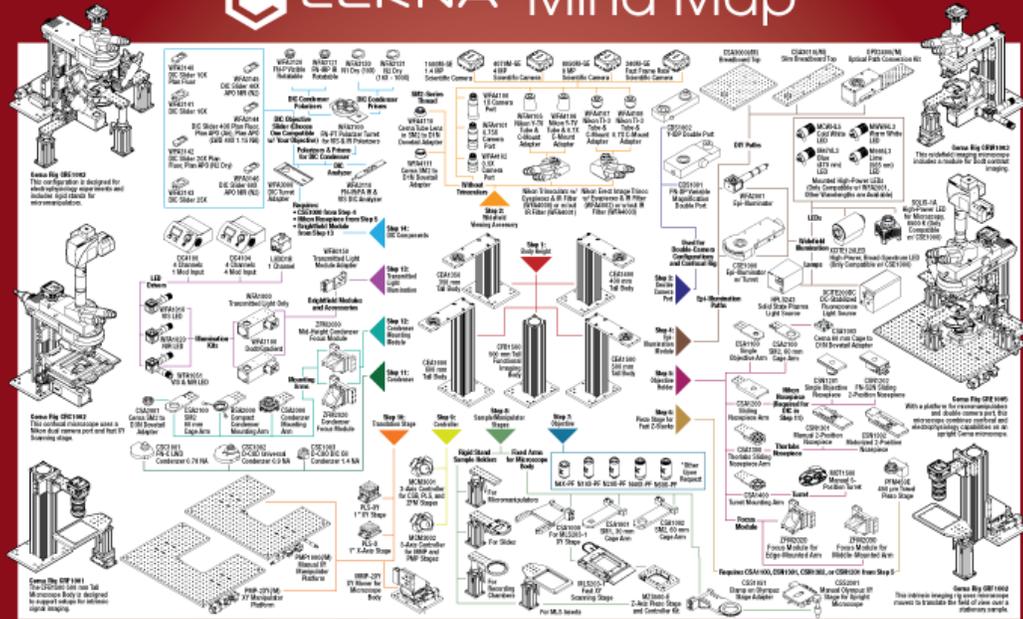
To learn which dovetail type(s) are on a particular component, consult its mechanical drawing, available by clicking on the red Docs icon () below. For adapters with a female dovetail, the drawing also indicates the size of the hex key needed for the locking setscrew(s). It is important to note that mechanical compatibility does not ensure optical compatibility. Information on optical compatibility is available from Thorlabs' web presentations.

For customers interested in machining their own dovetails, the table to the right gives the outer diameter and angle (as defined by the drawings below) of each Thorlabs dovetail designation. However, the dovetail's height must be determined by the user, and for circular dovetails, the user must also determine the inner diameter and bore diameter. These quantities can vary for dovetails of the same type. One can use the intended mating part to verify compatibility.

Thorlabs Dovetail Reference^a

Type	Shape	Outer Dimension	Angle
95 mm	Linear	95 mm	45°
D1N	Circular	Ø2.018"	60°
D2N ^b	Circular	Ø1.50"	90°
D2NB ^b	Circular	Ø1.50"	90°
D3N	Circular	Ø45 mm	70°
D5N	Circular	Ø1.58"	90°
D6N	Circular	Ø1.90"	90°
D7N	Circular	Ø2.05"	90°
D3T	Circular	Ø1.65"	90°
D1Y	Circular	Ø107 mm	60°
D2Y	Circular	Ø2.32"	50°
D3Y	Circular	Ø1.75"	90°
D4Y	Circular	Ø56 mm	60°
D5Y	Circular	Ø46 mm	60°
D6Y	Circular	Ø41.9 mm	45°
D1Z	Circular	Ø54 mm	60°
D2Z	Circular	Ø57 mm	60°
D3Z	Circular	Ø54 mm	45°

- a. These dovetail designations are specific to Thorlabs products and are not used by other microscope manufacturers.
- b. D2N and D2NB dovetails have the same outer diameter and angle, as defined by the drawings below. The D2N designation does not specify a height. The D2NB designation specifies a dovetail height of 0.40" (10.2 mm).

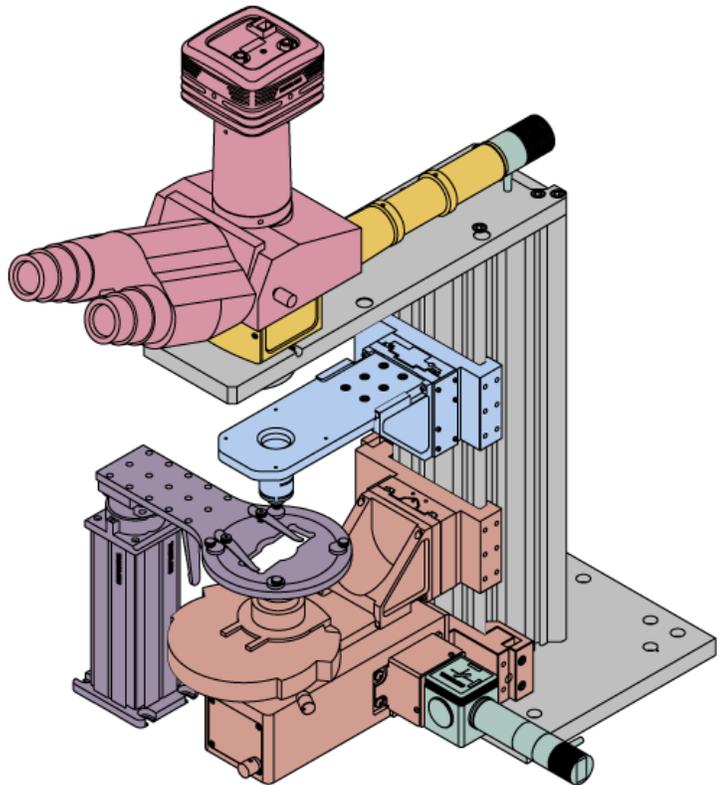


MICROSCOPE GUIDE

Elements of a Microscope

This overview was developed to provide a general understanding of a Cerna® microscope. Click on the different portions of the microscope graphic to the right or use the links below to learn how a Cerna microscope visualizes a sample.

- Terminology
- Microscope Body
- Illumination
- Sample Viewing/Recording
- Sample/Experiment Mounting



Terminology

Arm: Holds components in the optical path of the microscope.

Bayonet Mount: A form of mechanical attachment with tabs on the male end that fit into L-shaped slots on the female end.

Bellows: A tube with accordion-shaped rubber sides for a flexible, light-tight extension between the microscope body and the objective.

Breadboard: A flat structure with regularly spaced tapped holes for DIY construction.

Dovetail: A form of mechanical attachment for many microscopy components. A linear dovetail allows flexible positioning along one dimension before being locked down, while a circular dovetail secures the component in one position. See the *Microscope Dovetails* tab or here for details.

Epi-Illumination: Illumination on the same side of the sample as the viewing apparatus. Epi-fluorescence, reflected light, and confocal microscopy are some examples of imaging modalities that utilize epi-illumination.

Filter Cube: A cube that holds filters and other optical elements at the correct orientations for microscopy. For example, filter cubes are essential for fluorescence microscopy and reflected light microscopy.

Köhler Illumination: A method of illumination that utilizes various optical elements to defocus and flatten the intensity of light across the field of view in the sample plane. A condenser and light collimator are necessary for this technique.

Nosepiece: A type of arm used to hold the microscope objective in the optical path of the microscope.

Optical Path: The path light follows through the microscope.

Rail Height: The height of the support rail of the microscope body.

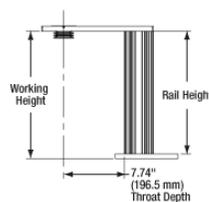
Throat Depth: The distance from the vertical portion of the optical path to the edge of the support rail of the microscope body. The size of the throat depth, along with the working height, determine the working space available for microscopy.

Trans-Illumination: Illumination on the opposite side of the sample as the viewing apparatus. Brightfield, differential interference contrast (DIC), Dodt gradient contrast, and darkfield microscopy are some examples of imaging modalities that utilize trans-illumination.

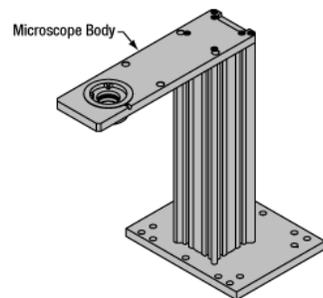
Working Height: The height of the support rail of the microscope body plus the height of the base. The size of the working height, along with the throat depth, determine the working space available for microscopy.

Microscope Body

The microscope body provides the foundation of any Cerna microscope. The support rail utilizes 95 mm rails machined to a high angular tolerance to ensure an aligned optical path and perpendicularity with the optical table. The support rail height chosen (350 - 600 mm) determines the vertical range available for experiments and microscopy components. The 7.74" throat depth, or distance from the optical path to the support rail, provides a large working space for experiments. Components attach to the body by way of either a linear dovetail on the support rail, or a circular dovetail on the epi-illumination arm (on certain models). Please see the *Microscope Dovetails* tab or here for further details.



[Click to Enlarge Body Details](#)



[Enlarge Cerna Microscope Body](#)

[Click to](#)



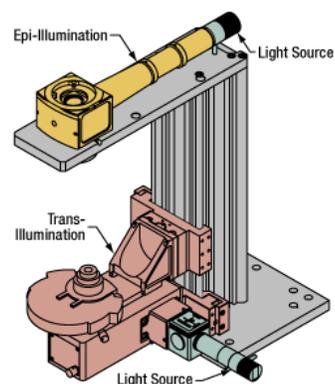
Illumination

Using the Cerna microscope body, a sample can be illuminated in two directions: from above (epi-illumination, see yellow components to the right) or from below (trans-illumination, see orange components to the right).

Epi-illumination illuminates on the same side of the sample as the viewing apparatus; therefore, the light from the illumination source (green) and the light from the sample plane share a portion of the optical path. It is

used in fluorescence, confocal, and reflected light microscopy. Epi-illumination modules, which direct and condition light along the optical path, are attached to the epi-illumination arm of the microscope body via a circular D1N dovetail (see the *Microscope Dovetails* tab or here for details). Multiple epi-illumination modules are available, as well as breadboard tops, which have regularly spaced tapped holes for custom designs.

Trans-illumination illuminates from the opposite side of the sample as the viewing apparatus. Example imaging modalities include brightfield, differential interference contrast (DIC), Dodt gradient contrast, oblique, and darkfield microscopy. Trans-illumination modules, which condition light (on certain models) and direct it along the optical path, are attached to the support rail of the microscope body via a linear dovetail (see *Microscope Dovetails* tab or here). Please note that certain imaging modalities will require additional optics to alter the properties of the beam; these optics may be easily incorporated in the optical path via lens tubes and cage systems. In addition, Thorlabs offers condensers, which reshape input collimated light to help create optimal Köhler illumination. These attach to a mounting arm, which holds the condenser at the throat depth, or the distance from the optical path to the support rail. The arm attaches to a focusing module, used for aligning the condenser with respect to the sample and trans-illumination module.



Click to

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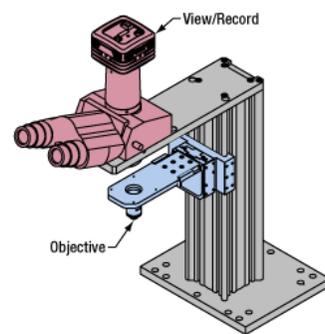
Illumination with a Cerna microscope can come from above (yellow) or below (orange). Illumination sources (green) attach to either.

Epi-Illumination Modules	Breadboards & Body Attachments	Brightfield	DIC	Dodt	Condensers	Condenser Mounting	Light Sources

Sample Viewing/Recording

Once illuminated, examining a sample with a microscope requires both focusing on the sample plane (see blue components to the right) and visualizing the resulting image (see pink components).

A microscope objective collects and magnifies light from the sample plane for imaging. On the Cerna microscope, the objective is threaded onto a nosepiece, which holds the objective at the throat depth, or the distance from the optical path to the support rail of the microscope body. This nosepiece is secured to a motorized focusing module, used for focusing the objective as well as for moving it out of the way for sample handling. To ensure a light-tight path from the objective, the microscope body comes with a bellows (not pictured).



Click to

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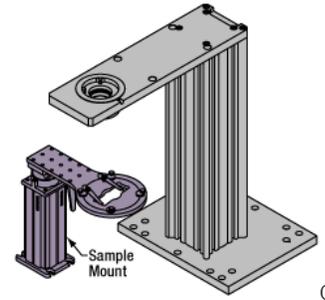
Light from the sample plane is collected through an objective (blue) and viewed using trinocs or other optical ports (pink).

Various modules are available for sample viewing and data collection. Trinoculars have three points of vision to view the sample directly as well as with a camera. Double camera ports redirect or split the optical path among two viewing channels. Camera tubes increase or decrease the image magnification. For data collection, Thorlabs offers both cameras and photomultiplier tubes (PMTs), the latter being necessary to detect fluorescence signals for confocal microscopy. Breadboard tops provide functionality for custom-designed data collection setups. Modules are attached to the microscope body via a circular dovetail (see the *Microscope Dovetails* tab or here for details).

Objectives & Accessories	Objective Mounting	Sample Viewing	Cameras	PMTs	Breadboards & Body Attachments

Sample/Experiment Mounting

Various sample and equipment mounting options are available to take advantage of the large working space of this microscope system. Large samples and ancillary equipment can be mounted via mounting platforms, which fit around the microscope body and utilize a breadboard design with regularly spaced tapped through holes. Small samples can be mounted on rigid stands (for example, see the purple component to the right), which have holders for different methods of sample preparation and data collection, such as slides, well plates, and petri dishes. For more traditional sample mounting, slides can also be mounted directly onto the microscope body via a manual XY stage. The rigid stands can translate by way of motorized stages (sold separately), while the mounting platforms contain built-in mechanics for motorized or manual translation. Rigid stands can also be mounted on top of the mounting platforms for independent and synchronized movement of multiple instruments, if you are interested in performing experiments simultaneously during microscopy.



Click to
Enlarge
The rigid stand (purple) pictured is one of various sample mounting options available.

Close

				
Translating Platforms	Rigid Stands	Translation Stages for Rigid Stands	Motorized XY Stages	Manual XY Stage

For sample viewing, Thorlabs offers trinoculars, double camera ports, and camera tubes. Light from the sample plane can be collected via cameras, photomultiplier tubes (PMTs), or custom setups using breadboard tops. Click here for additional information about viewing samples with a Cerna microscope.

Product Families & Web Presentations



Sample Viewing



Breadboards
& Body
Attachments



Cameras



PMTs

Close

Microscope objectives are held in the optical path of the microscope via a nosepiece. Click here for additional information about viewing a sample with a Cerna microscope.

Product Families & Web Presentations



Objectives



Objective Thread
Adapters



Parfocal Length
Extender



Piezo Objective
Scanner



Objective Mounting

Close

Large and small experiment mounting options are available to take advantage of the large working space of this microscope. Click here for additional information about mounting a sample for microscopy.

Product Families & Web Presentations



Translating Platforms



Rigid Stands



Translation Stages for Rigid Stands



Motorized XY Stages



Manual XY Stage

Close

Thorlabs offers various light sources for epi- and trans-illumination. Please see the full web presentation of each to determine its functionality within the Cerna microscopy platform.

Product Families & Web Presentations



Trans-Illumination Kits



Solis™ High-Power LEDs



Mounted LEDs



X-Cite® Lamps



Other Light Sources

Close

Epi-illumination illuminates the sample on the same side as the viewing apparatus. Example imaging modalities include fluorescence, confocal, and reflected light microscopy. Click here for additional information on epi-illumination with Cerna.

Product Families & Web Presentations



Epi-Illumination



Body Attachments



Light Sources

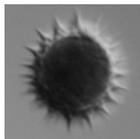
Close

Trans-illumination illuminates from the opposite side of the sample as the viewing apparatus. Example imaging modalities include brightfield, differential interference contrast (DIC), Dot gradient contrast, oblique, and darkfield microscopy. Click here for additional information on trans-illumination with Cerna.

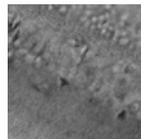
Product Families & Web Presentations



Brightfield



DIC



Dot



Condensers



Condenser Mounting



Illumination Kits



Other Light Sources

Close

The microscope body provides the foundation of any Cerna microscope. The 7.74" throat depth provides a large working space for experiments. Click here for additional information about the Cerna microscope body.

Product Families & Web Presentations



Microscope Bodies

Microscope Translator

Single-Objective Holders



Click to Enlarge
These nosepieces position an objective at the 7.74" throat depth of a DIY Cerna® system.

- ▶ Hold One Objective at 7.74" Throat Depth of a DIY Cerna System
- ▶ CSA1100: M32 x 0.75 Objective Threads and Slim Profile
- ▶ CSN1201: M32 x 0.75 Objective Threads and Slot for DIC Objective Prism
- ▶ Attach to Motorized Focusing Module for 1" of Fine Z Travel

These nosepieces hold a single objective at the 7.74" throat depth of a DIY Cerna system. Both are directly compatible with M32 x 0.75-threaded objectives.

The CSA1100 Single-Objective Nosepiece has a thin 0.38" profile that conserves distance along the optical path, maximizing the space available for other microscope modules. In contrast, the CSN1201 Single-Objective Nosepiece is 2.17" long, but has a slot that accepts a DIC objective prism.

The CSA1100 nosepiece ships with ring-type thread adapters for M25 x 0.75 and RMS (0.800"-36) objective threads, and has four 4-40 through taps for 60 mm cage systems. It can be directly attached to a motorized focusing module (shown below) via six M4 counterbores. Recessed magnets on top of the nosepiece mate to the bellows included with Cerna microscope bodies with epi-illumination arms, creating a light-tight optical path between the nosepiece and the epi-illumination arm.

In comparison, the CSN1201 nosepiece does not ship with any thread adapters, and is attached to a motorized focusing module via the CSA1200 Mounting Arm (sold separately). Recessed magnets on the CSA1200 arm mate to the bellows included with Cerna microscope bodies with epi-illumination arms, creating a light-tight optical path between the nosepiece and the epi-illumination arm.

For machining an arm utilizing non-standard nosepiece threading, consider the CSA1500 blank arm, which can also be attached to a motorized focusing module.

Item #	CSA1100	CSN1201
Number of Objectives	One	
Objective Threads	M32 x 0.75	
Included Objective Adapters	M32 x 0.75 to M25 x 0.75 M25 x 0.75 to RMS	None ^a
Slot for DIC Objective Prisms	No	Yes
Required Mounting Arm	None	CSA1200 Mounting Arm

- a. Our microscope thread adapters convert M32 x 0.75 threads to industry-standard objective threads. These adapters prevent overthreading of the objective, while adding distance to the optical path. Please take care to not overthread objectives when using ring-type thread adapters.



Part Number	Description	Price	Availability
CSA1100	Nosepiece for 1 Objective, M32 x 0.75 Threads, 60 mm Cage Compatible	\$177.48	Today
CSN1201	Nosepiece for 1 Objective, M32 x 0.75 Threads	\$693.60	Today
CSA1200	Mounting Arm for CSN1201 and CSN1202 Nosepieces	\$265.00	Today

Dual-Objective Nosepieces

- ▶ Hold Two Objectives in a DIY Cerna System
- ▶ CSN1301: M32 x 0.75 Objective Threads and Slim Profile
- ▶ CSN1202: M25 x 0.75 Objective Threads and Slots for DIC Objective Prisms
- ▶ Attach to Motorized Focusing Module for 1" of Fine Z Travel

Item #	CSN1301	CSN1202
Number of Objectives	Two	
Objective Threads	M32 x 0.75	M25 x 0.75
Included Objective Adapters	M32 x 0.75 to M25 x 0.75 (Qty. 2) M25 x 0.75 to RMS (Qty. 2)	None ^a
Per-Objective Parfocal Adjusters	No	Yes

These nosepieces hold two objectives in DIY Cerna systems. They are ideal for constructing systems that use a low-magnification objective to find a region of interest and a high-magnification objective to image.

The CSN1301 Dual-Objective Nosepiece has two positions that accept M32 x 0.75-threaded objectives, which support larger fields of view than M25 x 0.75-threaded objectives. In contrast, the CSN1202 only accepts M25 x 0.75-threaded objectives, but each position has a slot that accepts a DIC objective prism.

To switch between objectives, the CSN1301 nosepiece uses a sliding mechanism with detents that secure each objective into position. The nosepiece ships with ring-type thread adapters for M25 x 0.75 and RMS (0.800"-36) objective threads and is attached to a motorized focusing module via the CSA1300 Mounting Arm (sold separately). Recessed magnets on the CSA1300 arm mate to the bellows included with Cerna microscope bodies with epi-illumination arms, creating a light-tight optical path between the nosepiece and the epi-illumination arm. To support DIY systems that do not use a Cerna microscope body, the top of the nosepiece has four 4-40 taps for 30 mm cage systems. These taps are blocked when the CSA1300 arm is installed.

In comparison, the CSN1202 nosepiece switches between objectives using a mechanism that retracts the objective that is not in use, as demonstrated in the video below. Additionally, each objective position has an independent adjuster knob that can be used to fine tune the objectives' parfocality. To help ensure the objectives' relative centration, the front objective position has three 2 mm hex adjustment screws, arranged 120° apart, which adjust that objective's transverse position. This nosepiece does not ship with any objective thread adapters and is attached to a motorized focusing module via the CSA1200 Mounting Arm (sold separately). Recessed magnets on the CSA1200 arm mate to the bellows included with Cerna microscope bodies with epi-illumination arms, creating a light-tight optical path between the nosepiece and the epi-illumination arm.

Slots for DIC Objective Prisms	No	Yes
Required Mounting Arm	CSA1300 Mounting Arm	CSA1200 Mounting Arm

- a. Our RMSA1 thread adapter converts M25 x 0.75 threads to RMS threads. Please take care to not overthread objectives when using this and other ring-type thread adapters.



Click to Enlarge

The CSN1202 nosepiece retracts the objective that is not in use. It attaches to the motorized focusing module via the CSA1200 mounting arm, which is sold separately. For clarity, the nosepiece is shown here with objectives and objective prisms installed; these items are not included with the nosepiece.



Click for Details



Click for Details

The CSN1301 nosepiece can be mounted in two orientations. It attaches to the motorized focusing module via the CSA1300 mounting arm, which is sold separately. For clarity, the nosepiece is shown here with objectives installed; these items are not included with the nosepiece. Note also that the bellows shown here is longer than the standard bellows included with a microscope body.

Part Number	Description	Price	Availability
CSN1301	Nosepiece for 2 Objectives, M32 x 0.75 Threads, 30 mm Cage Compatible	\$2,538.78	Today
CSA1300	Mounting Arm for CSN1301 Nosepiece	\$450.00	Today
CSN1202	Nosepiece for 2 Objectives, M25 x 0.75 Threads	\$1,868.64	3-5 Days
CSA1200	Mounting Arm for CSN1201 and CSN1202 Nosepieces	\$265.00	Today

Piezo Objective Scanner and Paired Controller

- ▶ Enables Objective Positioning and Z-Stack Acquisition with Resolution Down to 1 nm
- ▶ Travel Range: 600 μm ± 10% in Open Loop; 450 μm in Closed Loop
- ▶



- Support for Heavy Objectives up to 500 g
- ▶ Maximum Clear Aperture of Ø29.0 mm Supports Large-Field-of-View Objectives
- ▶ Requires Microscope and Objective Adapters (Sold Separately)

[Click to Enlarge Exploded View](#)

[Click to Enlarge Assembled View](#)

The scanner is installed by threading a brass adapter into the microscope's objective holder with the included spanner wrench and tightening a flexure clamp around the adapter with the included 5/64" (2 mm) hex key. The objective is attached to the scanner using a separate brass adapter and flexure clamp.

The PFM450E Piezo Objective Positioner is designed for fine focus adjustment and high-speed Z-stack acquisition. Built-in capacitive feedback sensors allow the scanner to provide 1 nm resolution in open-loop operation and 3 nm resolution in closed-loop operation, enabling active compensation for short- and long-term drifts.

In order to permit easy switching between objectives, the piezo stage is attached to the microscope and objective by independent adapters. This design choice allows the objective to be removed without disconnecting the rest of the assembly. Adapters are available for M32 x 0.75, M27 x 0.75, SM1 (1.035"-40), M26 x 0.706, M25 x 0.75, and RMS (0.800"-36) threads. At least one microscope adapter and one objective adapter are required to install the scanner.

Each scanner is shipped with a piezo controller that has been factory calibrated to the specific scanner. Objective positioning is supported through the included standalone Kinesis® and APT™ GUIs, our ThorImageLS™ image acquisition software, an externally supplied control voltage, or the MZF001 Joystick Console (sold separately). The controller offers USB and RS-232 interfaces for computer control; a BNC input for sine, sawtooth, and square wave drive signals; a BNC output that gives either positioning feedback from the scanner's built-in capacitive sensors or a signal proportional to the piezo drive voltage; and a connector for the MZF001 joystick. In addition, a DB15 connector provides signals that can be used for synchronization with external equipment.

More details on this scanner are available at its full web presentation. Please note that if installing it on the CSN1301 Dual-Objective Nosepiece, the piezo stage and two adapters will add 11.5 mm of distance to the optical path, which will affect the objectives' parfocality. Also note that this scanner is not compatible with the CSN1202 Dual-Objective Nosepiece, as the flange on the PFMA05 Microscope Adapter will mechanically clash with the neighboring objective.

Part Number	Description	Price	Availability
PFM450E	Piezo Objective Scanner and Paired Controller	\$9,394.20	Today
PFMA01	Microscope Adapter for Piezo Objective Scanner, External M32 x 0.75 Threads	\$83.39	Today
PFMA01E	Microscope Adapter for Piezo Objective Scanner, External M32 x 0.75 Threads, Extended Flange	\$83.39	Today
PFMA03	Microscope Adapter for Piezo Objective Scanner, External M27 x 0.75 Threads	\$83.39	Today
PFMA09	Microscope Adapter for Piezo Objective Scanner, External SM1 Threads	\$83.39	Today
PFMA11	Customer Inspired!Microscope Adapter for Piezo Objective Scanner, External M26 x 0.706 Threads	\$91.80	Today
PFMA05	Microscope Adapter for Piezo Objective Scanner, External M25 x 0.75 Threads	\$83.39	Today
PFMA07	Microscope Adapter for Piezo Objective Scanner, External RMS Threads	\$83.39	Today
PFMA02	Objective Adapter for Piezo Objective Scanner, Internal M32 x 0.75 Threads	\$65.79	Today
PFMA04	Objective Adapter for Piezo Objective Scanner, Internal M27 x 0.75 Threads	\$64.52	Today
PFMA10	Objective Adapter for Piezo Objective Scanner, Internal SM1 Threads	\$64.52	Today
PFMA12	Customer Inspired!Objective Adapter for Piezo Objective Scanner, Internal M26 x 0.706 Threads	\$70.89	Today
PFMA06	Objective Adapter for Piezo Objective Scanner, Internal M25 x 0.75 Threads	\$64.52	Today
PFMA08	Objective Adapter for Piezo Objective Scanner, Internal RMS Threads	\$64.52	Today

SM2-Threaded Holder for Macro Lenses



- ▶ Nosepiece and Adapter Together Mount Nikon F-Mount Macro Lenses
- ▶ CSA2100: Internal SM2 (2.035"-40) Threads and 4-40 Taps for 60 mm Cage Systems
- ▶ SM2NFM: Female Nikon F-Mount and External SM2 Threads
- ▶ Attach to Motorized Focusing Module for 1" of Fine Z Travel

The CSA2100 Arm is designed to be mounted in a DIY Cerna system via the motorized focusing modules sold below. When combined with the SM2NFM Nikon F-Mount Adapter, it allows a Nikon F-Mount macro lens, or any camera lens with an F-Mount, to be mounted at the Cerna system's 7.74" throat depth.

This arm offers a slim 0.38" profile, internal SM2 (2.035"-40) threads, and four 4-40 through taps for Thorlabs' 60 mm cage systems. The SM2NFM adapter has a female F-Mount that accepts a lens and external SM2 threads that mate to the nosepiece.



[Click to Enlarge](#)
When the CSA2100 is attached to the microscope body, the internal SM2 threads and taps for 60 mm cage systems will be centered around the microscope's 7.74" throat depth.



[Click to Enlarge](#)
In this photo, our SM2NFM Nikon F-Mount Adapter is holding a macro lens for functional imaging.

The use of our standard SM2 threads also makes this arm compatible with any custom optical system mounted using our Ø2" lens tubes, as well as the CSA2001 D3N Dovetail Adapter sold below. More details on the Nikon F-Mount adapter and a version with a male F-Mount are available at its full web presentation.

To connect multiple macro lenses in tandem, as shown in the image to the right, consider using the M52A1 coupler to secure two M52 x 0.75-threaded lenses together.

Part Number	Description	Price	Availability
CSA2100	Arm, Internal SM2 Threads, 60 mm Cage Compatible	\$145.00	Today
SM2NFM	Adapter with External SM2 Threads and Nikon Female F-Mount Ring	\$93.08	Today

Condenser Holders

- ▶ BSA2000: Female D3N Dovetail, Two Adjusters, and Slim Profile
- ▶ CSA2000: Female D3N Dovetail, Orthogonal XY Adjusters, and 60 mm Cage Compatibility
- ▶ CSA2100: Internal SM2 (2.035"-40) Threads and 60 mm Cage Compatibility
- ▶ Attach to Focusing Module for 1" of Z Travel

These arms are designed to mount condensers at the 7.74" throat depth of DIY Cerna systems. All of these arms contain six M4 counterbores for direct attachment to either a motorized or manual focusing module (sold separately below).

The BSA2000 arm has a D3N dovetail that is directly compatible with any condenser offered by Thorlabs; the condenser is secured using a 2 mm hex setscrew. With a thickness of just 0.52", this arm conserves valuable space along the optical axis for items like our DIC accessories, Fast XY Scanning Stage, and user-built add-ons. It includes two adjusters with ±2.5 mm travel, allowing optimization of the illumination provided by the condenser.

In comparison, the CSA2000 arm, which also has a female D3N dovetail, is 1.86" thick so that it can incorporate orthogonal XY adjusters with ±2 mm travel. These adjusters therefore offer significantly reduced crosstalk, enabling faster optimization of the illumination conditions. Witness lines below the D3N dovetail give a reference for how far the condenser has traveled. In addition, the arm contains four Ø6 mm bores for 60 mm cage systems on the top, four 4-40 taps for 60 mm cage systems on the bottom, and 0.38" deep internal SM2 (2.035"-40) threads on the bottom.

The CSA2100 arm has a 0.38" thickness, internal SM2 through threads, and four 4-40 through taps for 60 mm cage systems. The use of our standard SM2 threads makes it compatible with any custom optical system mounted using our Ø2" lens tubes, as well as the CSA2001 D3N Dovetail Adapter sold below, which can be used to adapt it to our condensers.

For machining a holder utilizing non-standard threading or condenser attachment, consider the CSA1500 blank arm, which can also be attached to a motorized focusing module.

In addition, both the BSA2000 and CSA2000 are compatible with the LCPN1 condenser adapter for DIY setups. See below for details.



Click for Details
Here, a CSC1001 Condenser is mounted at a 7.74" throat depth using a CSA2000 Condenser Arm and a ZFM2020 Motorized Focusing Module.



Part Number	Description	Price	Availability
BSA2000	Condenser Arm, ±2.5 mm Travel per Adjuster, Female D3N Dovetail	\$705.84	Today
CSA2000	Condenser Arm, ±2 mm Travel in X & Y, Female D3N Dovetail, 60 mm Cage Compatible	\$705.84	Today
CSA2100	Arm, Internal SM2 Threads, 60 mm Cage Compatible	\$145.00	Toda

Motorized Focusing Modules with 1" Travel

- ▶ Provides Motorized Focusing Adjustment over 1" Travel Range
- ▶ 95 mm Dovetail Clamp on Back Connects to Microscope Body
- ▶ Includes Six M4 Cap Screws for Attaching Objective Nosepiece or Condenser Arm

Motorized Translation Stage Specifications ^a	
Travel Range	1" (25.4 mm)
Bidirectional Repeatability	1 µm
Backlash	1 µm

- ▶ Aligns Optical Port of Nosepiece or Arm at 7.74" Throat Depth of DIY Cerna System
- ▶ Operated by MCM3001 3-Axis Controller (Sold Separately)

Our Motorized Focusing Modules provide 1" of fine, variable-speed travel along the Z axis for optics in a DIY Cerna system. Each module consists of a 95 mm dovetail clamp that connects to the microscope body, a motorized translation stage, and a mounting bracket with six M4 tapped holes. As shown in the image below, these six M4 taps are spaced to mate with the M4 counterbores on our objective nosepieces and condenser arms. A permanently attached 6' (1.8 m) cable connects the module to our MCM3001 3-Axis Controller (sold separately).

We offer two versions of these stepper motor modules in order to allow the user to mount the arm (or nosepiece) in whatever manner makes the most efficient use of space. As shown in the drawing below, an arm that is mounted to the ZFM2020 Motorized Module will have one surface in the same plane as the edge of the module. Since this module can be secured to the microscope body in either of two orientations, both of which are shown in the image below, the arm can be positioned at the top or the bottom. In comparison, an arm that is mounted to the ZFM2030 Motorized Module will have one surface in the plane that bisects the module, which is 1.5" away from the module's edge.

When an arm is used with one of these modules, its optical port will be aligned at the 7.74" throat depth of the DIY Cerna system. The ZFM2020 and ZFM2030 modules use the same motorized translation stage; its specifications are given in the table to the right.

If purchasing a motorized focusing module for the CSN1301 Dual-Objective Nosepiece (described above), it is strongly recommended to choose the ZFM2030 module. The CSA1300 Mounting Arm, which is used to attach this nosepiece to the motorized focusing module, will mechanically clash with the ZFM2020 module in most mounting configurations.

Minimum Achievable Incremental Movement	100 nm
Minimum Achievable Repeatable Movement	200 nm
Velocity (Max)	7 mm/s
Acceleration (Max)	11 mm/s ²
Cable Length	6' (1.8 m)
Pin Diagram	Click to View
Load Capacity	
Stage Mounted to Vertical Rail^b	Recommended: ≤10 lbs (4.5 kg) Maximum: 10 lbs (4.5 kg)
Stage Mounted to Horizontal Rail	Recommended: ≤33.5 lbs (15.2 kg) Maximum: 42 lbs (19.1 kg)
Stepper Motor Specifications	

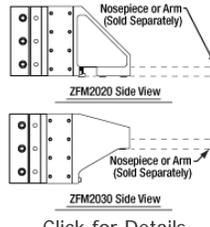
- a. The ZFM2020 and ZFM2030 modules use the same motorized translation stage.
- b. This is the orientation shown in the pictures below.



Click to Enlarge
Our motorized focusing modules attach to objective nosepieces and condenser arms using six M4 cap screws.



Click to Enlarge
The ZFM2020 module has two possible orientations, creating space along the optical path for an objective or condenser the module.



Click for Details

When using the ZFM2020 module, the surface of the nosepiece or arm will be flush with the bottom (or top) of the module.

When using the ZFM2030 module, the surface of the nosepiece or arm will be at the middle of

Part Number	Description	Price	Availability
ZFM2020	Motorized Module with 1" Travel for Edge-Mounted Arms	\$1,895.00	Today
ZFM2030	Motorized Module with 1" Travel for Middle-Mounted Arms	\$1,895.00	Today

Manual Focusing Modules for Condensers

- ▶ Provides Manual Focusing Adjustment over 1" Travel Range
- ▶ 95 mm Dovetail Clamp on Back Connects to Microscope Body
- ▶ Includes Six M4 Cap Screws for Attaching Condenser Arm
- ▶ Aligns Condenser Holder at 7.74" Throat Depth of DIY Cerna System
- ▶ Adjust Translation Stage Using Focusing Knobs

Our Manual Condenser Focusing Modules provide 1" of manual travel for a mounted condenser and its holder. Each module consists of a 95 mm dovetail

Manual Focusing Module Specifications	
Travel Range	1" (25.4 mm)
Distance per Degree Turn of Focus Knob^a	~2 mm / 30°
Load Capacity	
Stage Mounted to Vertical Rail	Recommended: ≤6.6 lbs (3 kg) Maximum: 11 lbs (5 kg)
Stage Mounted to Horizontal Rail	Recommended: ≤22 lbs (10 kg) Maximum: 33 lbs (15 kg)

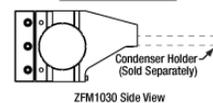
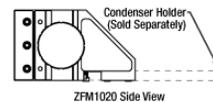
- a. The angular distance between each groove on the focus knob is 30°.

clamp that connects to the microscope body, a manual translation stage, and a mounting bracket with six M4 tapped holes. These six M4 taps are spaced to mate with the M4 counterbores on our condenser holders.

When mounting a condenser holder onto one of these manual focusing modules, the optical port will be aligned at the 7.74" throat depth of the DIY Cerna system. The focusing knobs on either side of the module can be used to translate the stage. The manual translation stage utilizes a dovetail translation mechanism to minimize long-term drift compared to stages with rolling bearings. While these manual focusing modules are mechanically compatible with objective nosepieces and holders, due to the high-precision focusing needs of objectives, we instead recommend our motorized focusing modules for objective mounting. Specifications for these manual focusing modules are provided in the table to the right.

We offer two versions of these manual focusing modules to allow the user to choose whichever module makes the most efficient use of space. As shown in the drawing on the right, a condenser holder that is mounted to the ZFM1020 Focusing Module will have one surface in the same plane as the edge of the module. This module can be secured to the microscope with the holder facing up or down. By comparison, a condenser holder mounted to the ZFM1030 Focusing Module will be mounted in the middle of the module.

When using the ZFM1020 module, the surface of the condenser holder will be flush with the bottom (or top) of the module.



[Click for Details](#)

When using the ZFM1030 module, the bottom surface of the condenser holder will be at the middle of the module.

Part Number	Description	Price	Availability
ZFM1020	Manual Condenser Focusing Module with 1" Travel for Edge-Mounted Arms	\$1,495.00	Today
ZFM1030	Manual Condenser Focusing Module with 1" Travel for Middle-Mounted Arms	\$1,495.00	Today

Motion Controller for Cerna Components with 1" Travel Range

- ▶ Designed for Cerna Components with 1" Motorized Travel
- ▶ Knobs Provide Hand-Operated Control for up to Three Axes
- ▶ Each Axis can be Individually Disabled to Prevent Unintended Movements or to Retain a Position
- ▶ Adjust Translation Speed via Top-Located Knob

Compatible Stages
Motorized Focusing Modules
Translation Stages for Rigid Stands

Controller Specifications

Compatible Motor Specifications



[Click to Enlarge MCM3001 Being Used to Control Both Axes of the PLS-XY and a ZFM2020 Focusing Module](#)

The MCM3001 3-Axis Controller consists of a hand-operated knob box and a separate controller, as shown in the photo to the right. Each side face of the knob box includes a rotating knob and a push-button switch that are dedicated to a single axis. The push-button switch enables and disables the axis, and is lit in green when the axis is enabled. Disabling the axis lets the user preserve a position or prevent accidental movements. A smaller knob on the top face adjusts the amount of translation per rotation of the knob (see the Controller Specifications table for details).

Since each MCM3001 controller has three channels, you only need to purchase enough channels for each of the modules you intend to drive. For example, a Cerna microscope equipped with a ZFM2020 Motorized Focusing Module (which has one axis) and a PLS-XY Translation Stage (two axes) would only require one MCM3001 controller.

The MCM3001 is compatible with motorized Cerna components that have a travel range of 1", such as our Motorized Focusing Modules and Translation Stages for Rigid Stands; see the Compatible Motor Specifications table for use with alternate motorized products. For components with a 2" travel range, such as our Translating Platforms, the MCM3002 controller should be used instead. If you would like a controller configured to drive more than one type of stage, please contact Tech Support.

SDK and LabVIEW examples are also available by contacting Tech Support.

Part Number	Description	Price	Availability
MCM3001	Three-Channel Controller and Knob Box for 1" Cerna Travel Stages	\$3,175.26	Today

Dovetail Adapters

- ▶ Extends Versatility of Thorlabs' Lens Tube and Cage Construction Systems to DIY Cerna Systems
- ▶ CSA2001: Female D3N Dovetail and External SM2 Threads
- ▶ LCPN1: Male D3N Dovetail, Internal SM30 Threads, 30 mm and 60 mm Cage Compatible

Item #	CSA2001	LCPN1
Dovetail^a	Female D3N	Male D3N
SM Threading	External SM2 (2.035"-40)	External SM30 (30.5 x 0.5)
Cage Compatibility	None ^b	30 mm Cage System (4-40 Tap ^c , 4 Places) 60 mm Cage System (Ø6 mm Bore, 4 Places)
Clear Aperture	Ø1.58" (40.0 mm)	Ø1.10" (27.9 mm)
Adapter Profile (Click for Drawing)		



Click to Enlarge
Our CSA2001 adapter has a female D3N dovetail that mates to the male D3N dovetail on a condenser. Here, the external SM2 threads on the adapter are threaded into our CXY2 mount.

These dovetail adapters allow DIY light conditioning setups to be integrated into a Cerna microscope. The CSA2001 is used to mount a condenser to an optical assembly that uses Thorlabs' SM2 lens tubes. A 2 mm hex setscrew is included to secure the dovetail of the adapter to the condenser. The LCPN1 is used to mount a custom condenser configuration onto a Cerna Microscope. The adapter includes two SM30RR retaining rings to secure an optic to the inside of the adapter.

- a. Additional information on dovetails is available in the *Microscope Dovetails* tab.
- b. An SM2-threaded cage plate can be used to adapt the CSA2001 adapter to a 60 mm cage system.
- c. These tapped holes are on the opposite side of the dovetail only.

See the table to the right for the mechanical features of each adapter.

Part Number	Description	Price	Availability
CSA2001	Adapter with Female D3N Dovetail and External SM2 Threads	\$297.84	Today
LCPN1	Nikon Eclipse or Cerna Microscope Condenser Adapter, Male D3N Dovetail, Internal SM30 Threads, 30 and 60 mm Cage Compatibility	\$93.50	Today