

CSE1000 - August 28, 2018

Item # CSE1000 was discontinued on August 28, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

EPI-ILLUMINATION FOR DIY CERNA® SYSTEMS

▶ **Modular, User-Configurable Epi-Illuminator Modules**

▶ **Breadboard Tops for Custom Illumination**

▶ **Exchange Fluorescence Filter Sets Using a Turret or Cube**

Application Idea
 Cerna® Microscope with
 CSE2100 Epi-Illuminator Turret





WFA2001
Single-Cube Epi-Illuminator Module



MDFM-MF2
Filter Cube for Single-Cube Epi-Illuminator Modules



CSE2100
Epi-Illuminator Module with Removable Filter Turret



CSE2000W
Extra Removable Filter Turret




OPX2400
Breadboard Top with Two-Position Slider

[Hide Overview](#)


OVERVIEW

Features


- Optical Ports Aligned with 7.74" Throat Depth of DIY Cerna® Systems
- Ready-to-Use Epi-Illuminator Modules
 - One Filter Cube Slot, Six Filter Cube Slots, or Removable Turret for Six Filter Sets
 - Compatible with Uncollimated or Collimated Illumination Sources
 - CSE2100 and CSE2200 Offer Additional Optical Side Port
- DIY Epi-Illuminator Modules
 - One Filter Cube Slot or Removable Turret for Six Filter Sets
 - SM1, SM2, 30 mm Cage, and/or 60 mm Cage Compatible (See *Selection Guide* Below)
- Breadboard Tops
 - 1/4"-20 (M6 x 1.0) Tapped Holes
 - OPX2400 has Two-Position Slider for Combining or Switching Between Optical Paths
- Fluorescence Filter Cubes for WFA200x and CSE1000 Epi-Illuminator Modules
- Extra Removable Filter Turrets for CSE2xxx Epi-Illuminator Modules
- Collimation Adapters for Liquid Light Guide (LLG) Integration
- Dovetail Adapters for Thorlabs' Lens Tube and Cage Construction Systems




Click to Enlarge
The epi-illumination arm of the microscope body has a female D19 dovetail aligned with the 7.74" throat depth.



Click to Enlarge
The dovetail aligns the epi-illumination module with the optical path of the microscope.




Click to Enlarge
As an alternative or as a supplement to an epi-illumination module, our breadboard tops can be used.



Click to Enlarge
Together, these components allow user-built microscopes to be constructed with a high degree of modularity.

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.



We offer several epi-illumination modules and accessories for constructing epi-illumination pathways in DIY Cerna systems. These components are used to guide light through the objective and generate intense illumination across the field of view.

Our Ready-to-Use Epi-Illuminator Modules condition incoming light to provide even illumination across the field of view at the sample plane. The WFA2001 and CSE1000 ship ready to connect to illumination sources such as Thorlabs' mounted LEDs, high-power Solis™ microscopy LEDs, and X-Cite® lamps, while the CSE2100 and CSE2200 accept collimated illumination sources that are coupled into our Ø1" lens tubes, Ø2" lens tubes using an adapter, and 30 mm and 60 mm cage systems. Alternatively, our DIY Epi-Illuminator Modules, Breadboard Tops, and Breadboard Top with Two-Position Slider enable completely home-built illumination setups. See the selection guide below for additional details.

We offer a range of microscopy filter cubes for the WFA2001, WFA2002, and CSE1000 Epi-Illuminator Modules. For the CSE2000, CSE2100, and CSE2200 Epi-Illuminator Modules, we have designed the CSE2000W Filter Turret, which holds up to six filter sets directly without the need for separate filter cubes.

Both the filter cubes and filter turret accept Ø25 mm excitation and emission filters and 25 mm x 36 mm dichroic mirrors, making them compatible with filters from all major manufacturers. We also manufacture 25 mm x 36 mm plate beamsplitters for white-light imaging with epi-illumination and a 25 mm x 36 mm protected silver mirror.

Selection Guide

Item #	WFA2001 ^a	WFA2002	CSE2100 ^a	CSE2200 ^a	CSE2000	CSE1000	CSA3000/(M)	CSA3010/(M)	OPX2400/(M)
Epi-									Breadboard

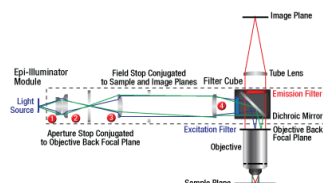
Illuminator Module Type	Ready to Use	DIY	Ready to Use	DIY	Ready to Use	Breadboard Top		Top with Two-Position Slider
Fluorescence Filter Set Mounting	One Filter Cube (Not Included)		Turret for Six Filter Sets (Included)		Up to Six Filter Cubes (Not Included)	N/A	N/A	N/A
Compatible Illumination Source	Uncollimated	User-Constructed Optical Path ^b	Primary Path: Collimated Additional Path: User-Constructed, Uncollimated	User-Constructed Optical Path ^b	Collimated	User-Constructed Optical Path ^b		
Illumination Source Mounting	SM1 Threads Ø3 mm LLG	SM1 Threads 30 mm Cage System	D3T Dovetail 60 mm Cage System Additional Optical Port: SM1 Threads 30 mm Cage System	60 mm Cage System	Female Nikon Bayonet Mount	1/4"-20 (M6 x 1.0) Taps	1/4"-20 (M6 x 1.0) Taps 30 mm Cage System 60 mm Cage System	1/4"-20 (M6 x 1.0) Taps SM2 Threads 60 mm Cage System

a. The *Optical Diagrams* tab contains ray diagrams for these epi-illuminator modules.

b. These modules don't come with a preconfigured optical path to accept an illumination source. They are designed for users that want to design their own optical path.

[Hide Optical Diagrams](#)

OPTICAL DIAGRAMS

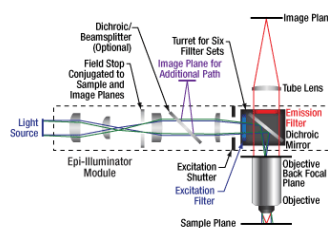


Click to Enlarge

WFA2001 Ready-to-Use Epi-Illuminator Module

The WFA2001 includes a field stop, aperture stop, and optical elements that produce homogeneous illumination across the field of view. It contains one filter cube slot for holding a fluorescence filter set, a beamsplitter with crossed polarizers, a mirror, or a polarizing bandpass filter. It is designed for an uncollimated illumination source.

WFA2001 Lenses			
1	AL2018-A	3	LBF254-040-A
2	LBF254-040-A	4	LBF254-100-A
Zemax Black Box			



Click for Details

CSE2100 and CSE2200 Ready-to-Use Epi-Illuminator Module

In addition to a field stop and optical elements that provide homogeneous illumination across the field of view, these modules feature an additional optical side port. The primary optical path is designed for a collimated illumination source and the additional optical path is designed for a focused illumination source at a distance D1 from the module body (see enlarged diagram). The working distance between the bottom of the module and the back focal plane of the objective (D2 in enlarged diagram) is 50 mm for the CSE2100 and 150 mm for the CSE2200. Both the CSE2100 and CSE2000 contain a removable filter turret, providing room for up to six fluorescence filter sets, beamsplitters with crossed polarizers, mirrors, or polarizing bandpass filters.

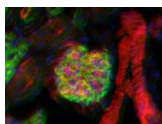
Please note that, unlike the WFA2001, the CSE2100 and CSE2000 use lenses not currently sold separately by Thorlabs.

CSE2100
Zemax Black Box

[Hide Imaging Modalities](#)

IMAGING MODALITIES

Cerna[®] microscopes support several imaging modalities, including epi-fluorescence, brightfield illumination, differential interference contrast (DIC) imaging, and Dodt gradient contrast imaging. Each of these methods requires different accessories and confers different advantages to the microscopist, as described below.

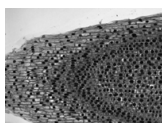


Click to Enlarge
Epi-Fluorescence Image of Mouse Kidney with Multiple Labels

Epi-Fluorescence

Epi-fluorescence makes use of fluorescent labels and intrinsic fluorescence in a specimen to identify sample features. To create an epi-fluorescence image, light that has been passed through an excitation filter is directed through an objective and absorbed by a sample. This excitation causes fluorophores within the sample to emit light of a longer wavelength (i.e., lower energy) than the excitation light. Some of this emitted light is collected by the objective, which helps direct the emission onto a camera for observation. Additional details on this imaging modality are available here.

For performing epi-fluorescence measurements in DIY Cerna systems, we offer a range of widefield viewing and epi-illumination accessories, as well as fluorescence filter sets targeted at common fluorophores.



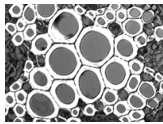
Click for Details
Brightfield Image of Onion Mitosis

Brightfield Illumination

Brightfield illumination is the simplest method of trans-illumination. In this modality, light from an illumination source is collected by a condenser and passed through a sample, which is observed by its effect on the intensity of the transmitted light. Brightfield illumination only requires an illumination source (i.e., an illumination kit) and a condenser to be attached to a DIY Cerna system.

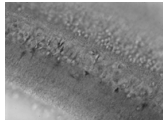
DIC Imaging

In differential interference contrast (DIC) imaging, light transmitted through the sample is manipulated by a number of polarization optics. Light from the illumination source is polarized and then split into two orthogonally polarized beams before



Click to Enlarge
DIC Image of a Buttercup Root

it reaches the sample. Small differences in the optical path length experienced by the two beams cause interference when the beams are recombined, providing enhanced contrast for sample features that would be transparent under brightfield illumination. In addition to an illumination source and a condenser, DIC imaging requires several additional optical elements: a DIC polarizer, a condenser prism, an objective prism, and an analyzer.

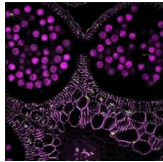


Click to Enlarge
DotD Contrast Image of a
Mouse Retina

DotD Contrast

DotD gradient contrast, also known more simply as DotD contrast, can be understood as an improvement upon oblique illumination. Both methods use a mask to generate an illumination gradient, but in DotD contrast, the mask occurs much earlier in the optical path. This configuration improves the image contrast to a point where it is comparable to that obtained using DIC.

The DotD illumination gradient is generated using a specially shaped quarter annulus and diffusers, and reveals thickness changes in a sample over the field of view. Compared to brightfield illumination, DotD contrast offers improved resolution of sample features, and compared to DIC, it allows thicker samples to be studied. Thorlabs manufactures a pre-configured, pre-aligned illumination module for DotD contrast that generates the desired gradient; it requires an illumination source and a condenser for operation.



Click to Enlarge
Laser Scanned Image of a
Flower Bud

Laser Scanning

Like epi-fluorescence, laser scanning makes use of fluorescent labels and intrinsic fluorescence in a specimen to identify sample features. Unlike epi-fluorescence, laser scanning is able to resolve thin individual planes relatively deep into a thick sample, enabling 3D volumetric images and opening the door to *in vivo* studies.

Laser scanning techniques (e.g., multiphoton and confocal microscopy) rely upon the coherence of laser beams to provide significantly improved axial resolution. In confocal microscopy, a pinhole eliminates the out-of-focus light that would reduce the axial resolution (as it does in epi-fluorescence), while in multiphoton microscopy, the necessity of two- or three-photon absorption by the fluorophore, a low-probability event, effectively creates optical sections.

Additional details are available at our laser scanning microscopy tutorial.

[Hide Microscope Dovetails](#)

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.

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.

In order to reduce wear and simplify connections, dovetails are often machined with chamfers, recesses, and other mechanical features. Some examples of these variations are shown by the drawings below.



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.

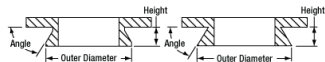


Click to Enlarge
This photo shows the male D1N dovetail on the trinoculars next to the female D1N dovetail on the epi-illumination arm.

Thorlabs 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°
D1T	Circular	Ø1.50"	60°
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.

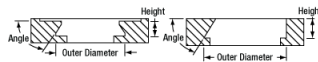
b. D2N and D2NB dovetails have the same outer diameter and angle, as defined by the drawings below. The D2N designation does not specify a height. The D2NB designation specifies a dovetail height of 0.40" (10.2 mm).



Male Dovetail Examples

[Click to Enlarge](#)

Two examples of how circular male dovetails can be manufactured.



Female Dovetail Examples

[Click to Enlarge](#)

Two examples of how circular female dovetails can be manufactured.

[Hide DIY Cerna Interfaces](#)

DIY CERNA INTERFACES

Standard Mechanical Interfaces on DIY Cerna® Components

The table below gives the dovetail, optical component threads, and cage system interfaces that are present on each DIY Cerna component. If a DIY Cerna component does not have one of the standard interfaces in the table, it is not listed here. Please note that mechanical compatibility does not ensure optical compatibility. Information on optical compatibility is available from Thorlabs' web presentations.

Item #	Microscope Dovetails									Optical Component Threads ^a				Cage Systems ^b	
	95 mm	D1N	D2N	D2NB	D3N	D5N	D1T	D3T	D1Y	C-Mount ^c (1.00"-32)	SM1 ^d (1.035"-40)	SM30 (M30.5x0.5)	SM2 ^e (2.035"-40)	30 mm ^d	60 mm ^e
2SCM1-DC											Internal & External		Internal	Yes	Yes
BSA2000 ^f					Female										
CEA1350	Male	Female													Yes
CEA1400	Male	Female													Yes
CEA1500	Male	Female													Yes
CEA1600	Male	Female													Yes
CFB1500	Male														
CSA1000	Female														
CSA1001	Female										Internal			Yes	
CSA1002	Female												Internal		Yes
CSA1003		Female													Yes
CSA1051	Female							Male							
CSA1200 ^{f,g}															Yes
CSA1400 ^f							Female								Yes
CSA1500 ^{f,h}															
CSA2000 ^f					Female								Internal		Yes
CSA2001					Female								External		
CSA2100 ^f													Internal		Yes
CSA3000(/M)		Male													
CSA3010(/M)		Male												Yes	Yes
CSC1001					Male										
CSC1002					Male										
CSC1003					Male										
CSC2001					Male										
CSD1001		Male & Female		Female											
CSD1002		Male & Female								External					
CSE1000 ⁱ		Male & Female													
CSE2000		Male & Female													Yes
CSE2100		Male & Female						Female		Internal				Yes	Yes
CSE2200		Male & Female						Female		Internal				Yes	Yes
CSN100 ^{f,j}															Yes
CSN200 ^l								Male							
CSN210 ^l								Male							
CSN500 ^k								Male							
CSN510 ^l								Male							
CSN1201 ^{9,j}															
CSN1202 ^{9,k}															
CSS2001									Female						
LCPN1					Male						Internal			Yes	Yes
LCPN2		Male									Internal			Yes	Yes
Item #	95 mm	D1N	D2N	D2NB	D3N			D3T	D1Y	C-Mount	SM1	SM30	SM2	30 mm	60 mm

OPX2400(M)		Male & Female											Internal		Yes	
SM1A58			Male	Male									Internal		External	Yes
SM2A56								Male							External	
WFA0150	Female															
WFA1000																Yes
WFA1010													Internal			Yes
WFA1020													Internal			Yes
WFA1051													Internal			Yes
WFA1100																Yes
WFA2001		Male & Female											Internal & External			
WFA2002		Male & Female											Internal			Yes
WFA4000		Male	Female													
WFA4001		Male	Female													
WFA4002		Male					Female									
WFA4003		Male					Female									
WFA4100		Male										External	Internal			
WFA4101		Male										External	Internal			
WFA4102		Male										External	Internal			
WFA4105			Male										External			
WFA4106			Male										External			
WFA4107							Male						External			
WFA4108							Male						External			
WFA4109							Male						External			
WFA4110		Male												External		
WFA4111		Male												External		
WFA4112							Male						External			
XT95P11(M)	Female															
XT95P12(M)	Female															
ZFM1020	Female															
ZFM1030	Female															
ZFM2020	Female															
ZFM2030	Female															

- a. Thorlabs' optical component thread adapters can be used to convert between C-Mount threads, SM1 threads, SM2 threads, and virtually every other optical thread standard.
- b. Our cage system size adapters and drop-in adapter can be used to convert between 16 mm, 30 mm, and 60 mm cage systems.
- c. C-Mount and CS-Mount standards feature the same 1.00"-32 threads, but C-Mounts have a 5 mm longer flange-to-sensor distance.
- d. Our 30 mm cage plates can convert between SM1 lens tubes and 30 mm cage systems.
- e. Our 60 mm cage plates can convert between SM2 lens tubes and 60 mm cage systems.
- f. Attach to a ZFM focusing module to add a female 95 mm dovetail.
- g. The CSA1200 mounting arm is compatible with the CSN1201 and CSN1202 nosepieces.
- h. This blank arm is designed for custom DIY machining for non-standard components, threads, and bores.
- i. This epi-illuminator module has a female Nikon bayonet mount, which can be connected to our SM1 lens tubes, SM2 lens tubes, and 30 mm cage system using our lamphouse port adapters.
- j. This nosepiece directly accepts M32 x 0.75 objective threads.
- k. This nosepiece directly accepts M25 x 0.75 objective threads.
- l. This nosepiece directly accepts RMS (0.800"-36) objective threads.

[Hide Cerna Videos](#)

CERNA VIDEOS

Building a Cerna® Microscope

The Cerna microscopy platform's large working volume and system of dovetails make it straightforward to connect and position the components of the microscope. This flexibility enables simple and stable set up of a preconfigured microscope, and provides easy paths for later upgrades and modification. See below for a couple examples of the assembly of preconfigured and DIY Cerna microscopes.

Preconfigured Microscope Kit Design and Assembly

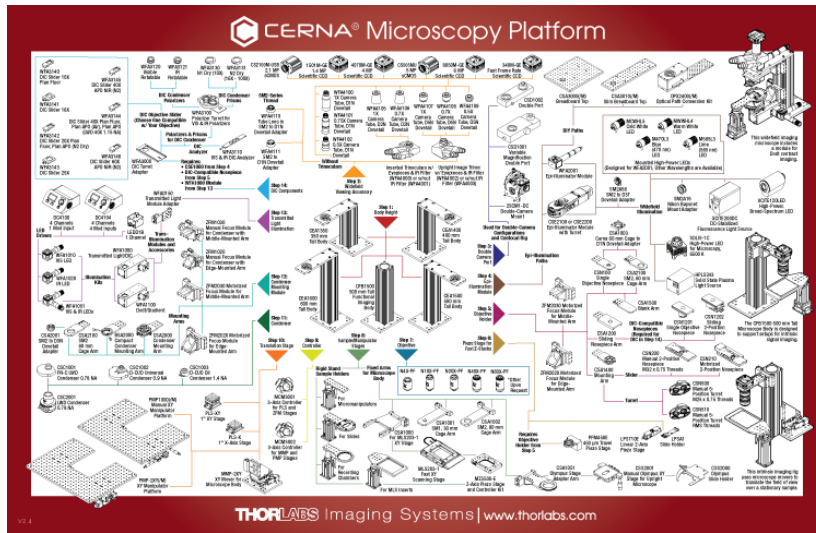
DIY Cerna Design and Assembly

[Hide Cerna Mind Map](#)

CERNA MIND MAP

The Cerna™ Mind Map is a visual tool that contains the complete selection of DIY Cerna components and several closely related accessories. Created as a supplement to our website, we have designed it to be printed on a single 11" x 17" sheet.

Click here or on the image below to download a printable PDF. The components shown on this webpage are in Steps 2, 4, and 5 of the mind map.



[Hide Microscope Guide](#)

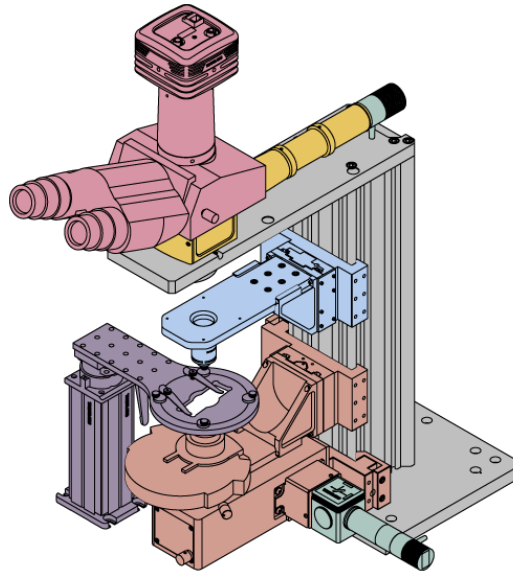
MICROSCOPE GUIDE

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

Click on the different parts of the microscope to explore their functions.



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.

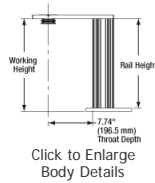
Throat Depth: The distance from the vertical portion of the optical path to the edge of the support rail of the microscope body. The size of the throat depth, along with the working height, determine the working space available for microscopy.

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

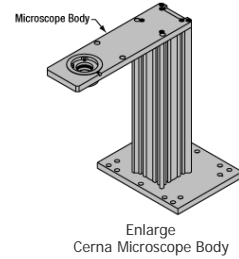
Working Height: The height of the support rail of the microscope body plus the height of the base. The size of the working height, along with the throat depth, determine the working space available for microscopy.

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



Click to

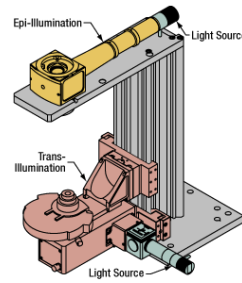
Microscope Bodies	Microscope Translator

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), Dot 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.



Enlarge

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

Click to

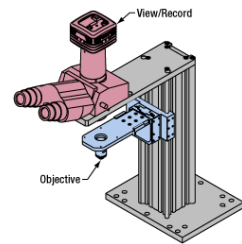
Epi-Illumination Modules	Breadboards & Body Attachments	Brightfield	DIC	Dot	Condensers	Condenser Mounting	Light Sources

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).

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).



Enlarge

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

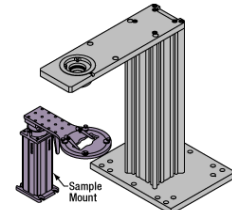
Click to

--	--	--	--	--	--	--

					
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.



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





Click to

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.



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

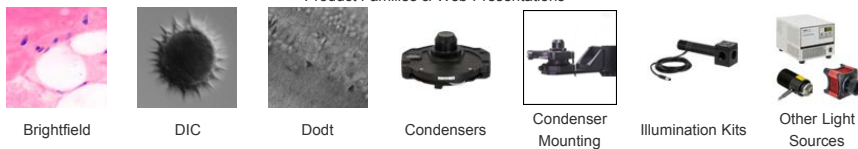
Body Attachments

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), Dodt gradient contrast, oblique, and darkfield microscopy. Click here for additional information on trans-illumination with Cerna.

Product Families & Web Presentations



Brightfield

DIC

Dodt

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

[Hide Epi-Illuminator Modules for One Filter Cube](#)

Epi-Illuminator Modules for One Filter Cube

- ▶ WFA2001: Pre-Installed Optical Path that Accepts an Uncollimated Illumination Source with a Ø3 mm Core Liquid Light Guide or SM1 Threads Installation of a Filter Set and Filter Cube into a Single-Cube Epi-Illuminator Module
- ▶ WFA2002: Build Your Own Optical Path using SM1 and 30 mm Cage Components
- ▶ Magnetic Door Cover Holds One Olympus-Compatible Filter Cube
- ▶ Stackable Design with Female and Male D1N Dovetails on Top and Bottom, Respectively
- ▶ Filter Cube is Sold Separately from Epi-Illuminator Module

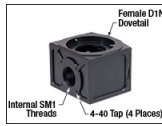
These epi-illuminator modules hold one filter cube in the epi-illumination pathway of a DIY Cerna system. With a female D1N dovetail on top and a male D1N dovetail on the bottom, they are designed to mate with the epi-illumination arm of a Cerna microscope body, as well as with each other. Additional details on dovetails are available in the *Microscope Dovetails* tab.

The WFA2001 Epi-Illuminator Module's optical input port has internal SM1 (1.035"-40) threads. For this port, we include two adapters: an adapter that accepts a Ø3 mm core liquid light guide, such as that of the HPLS343 and XCITE200DC lamps, and an SM1T10 adapter that accepts an uncollimated light source with an internally SM1-threaded output, such as a mounted LED. For use with a Ø5 mm core liquid light guide, the AD5LLG adapter is available for purchase separately. The module's pre-installed optical path consists of collimating optics that are AR coated for 350 - 700 nm, as well as field stop and aperture stop diaphragms (Item # SM1D12D) that can be adjusted from Ø0.8 mm to Ø12.0 mm (Ø0.03" to Ø0.47"). The optical schematic of this epi-illuminator module is shown in the *Optical Diagrams* tab.

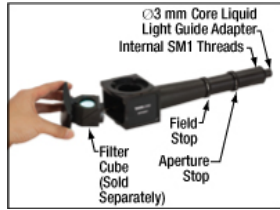
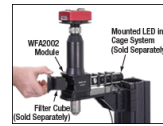
In contrast, the WFA2002 Epi-Illuminator Module does not include the pre-installed optical path of the WFA2001. As shown by the photo below, removing the optical path exposes internal SM1 threads and four 4-40 taps for 30 mm cage systems on the back of the module. These mechanical interfaces enable Thorlabs' extensive selection of SM1 and 30 mm cage components to be used to build custom epi-illumination paths.

Each of these modules includes a magnetically secured cover that can be connected to a MDFM-MF2 Filter Cube (sold separately), as shown by the animation above. Extra covers, which the user can attach to the filter cubes to speed up filter cube exchange, are sold as Item # WFA2001C.

Please note that these epi-illuminators do not have the slot required for the WFA3110 DIC Analyzer, so a custom mounting solution will be needed. The CSE2100 and CSE2000 Epi-Illuminator Modules sold below are directly compatible with this DIC analyzer.



The back of the WFA2002 Epi-Illuminator Module has internal SM1 threads and four 4-40 taps for a 30 mm cage system, which can be used to support home-built epi-illumination setups.



The WFA2001 Epi-Illuminator Module has a ready-to-use beam path, with field stop and aperture stop diaphragms, for a mounted LED, the HPLS343 lamp, or another uncollimated source with SM1 threads or a Ø3 mm liquid light guide.

Part Number	Description	Price	Availability
WFA2001	Epi-Illuminator Module for 1 Cube, Conditioning Optics, Male & Female D1N Dovetails	\$1,732.98	Today
WFA2002	Epi-Illuminator Module for 1 Cube, Male & Female D1N Dovetails	\$395.00	Today
WFA2001C	Extra Filter Cube Cover for WFA2001 and WFA2002 Epi-Illuminator Modules	\$177.48	Today

[Hide Epi-Illuminator Modules with Removable Turret for Six Filter Sets](#)

Epi-Illuminator Modules with Removable Turret for Six Filter Sets

- ▶ Included Removable Turret Holds Up to Six Filter Sets without the Need for Filter Cubes
- ▶ Stackable Design with Female and Male D1N Dovetails on Top and Bottom, Respectively
- ▶ Directly Compatible with WFA3110 DIC Analyzer
- ▶ Monitor Filter Turret Position on a PC Using Included Software Package
- ▶ Ready-to-Use Epi-Illuminator Modules with Beam Conditioning Optics
 - ▶ CSE2100: For Cerna Microscope Bodies with ~50 mm Epi-Illumination Path Length
 - ▶ CSE2200: For Cerna and Confocal Microscopes with ~150 mm Longer Epi-Illumination Path Lengths
- ▶ Do-It-Yourself CSE2000 Epi-Illuminator Module without Beam Conditioning Optics
- ▶ Side Port for Additional Optical Path Included on CSE2100 and CSE2200

Turret Position Sensor Software

Version 3.2 (December 27, 2017)

This software package contains the installation files for the GUI interface, driver, SDK, and support documentation. The software is compatible with Windows® 7 (64-bit) systems.

[Software](#)



The CSE2000 Epi-Illuminator Module features 4-40 taps to connect to a 60 mm cage system.

These Epi-Illuminator Modules hold a rotating, removable turret in the epi-illumination pathway of a DIY microscope system. One turret is included with each epi-illuminator module, and additional turrets can be purchased separately below (Item # CSE2000W). Fluorescence filter sets, beamsplitters, mirrors, and/or polarizing bandpass filters can be directly loaded into the turret without the need for filter cubes. In all models, turret position may be monitored remotely on a PC (not included) with included software; see the Software box at the top right to download the GUI installation files. In addition, a tab opens and closes a shutter that blocks the optical path directed through the excitation filter.

Unlike the WFA2001 and WFA2002 Epi-Illuminator Modules sold above, the CSE2000, CSE2100, and CSE2200 Epi-Illuminator Modules have a slot for direct compatibility with the WFA3110 DIC Analyzer.

Microscope Compatibility

With a female D1N dovetail on top and a male D1N dovetail on the bottom, these modules are designed to mate with the epi-illumination arm of a Cerna microscope body, Thorlabs' confocal microscopes, the breadboard tops sold below, other epi-illumination modules, and other widefield viewing accessories. Additional details on dovetails are available in the *Microscope Dovetails* tab.

Ready-to-Use Epi-Illuminator Modules

The CSE2100 and CSE2200 include beam conditioning optics optimized for homogeneous illumination at the sample plane. The CSE2100 is designed so that evenness of illumination is optimized at a 50 mm working distance between the bottom of the module and the back focal plane of the objective. The CSE2200 Epi-Illuminator Module is designed to provide a longer working distance of 150 mm, ideal for use with a Thorlabs confocal microscope system or Cerna microscopes that require additional optics between the module and the objective lens. For details, see optical diagram to the lower right.

Both the CSE2100 and CSE2200 Epi-Illuminator Modules features AR-coated optical elements designed for homogeneous illumination over 365 - 700 nm, as well as a field stop diaphragm, creating a ready-to-use optical path for the epi-illumination source. A collimated illumination source, such as our Solis High-Power LED, can be attached using the female D3T dovetail on the back of the module; the SM2A56 adapter and LLG collimation adapters are sold below. Alternatively, by removing the back piece, a 60 mm cage system can be mounted using the 4-40 taps.

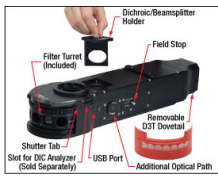
An additional optical path can also be utilized by inserting a beamsplitter or dichroic (30 mm x 42 mm, 2.0 ± 0.1 mm in thickness) into the module; please contact Tech Support for compatible dichroics or beamsplitters. This side port features internal SM1 (1.035"-40) threading as well as 4-40 taps for our 30 mm cage system.

DIY Epi-Illuminator Module

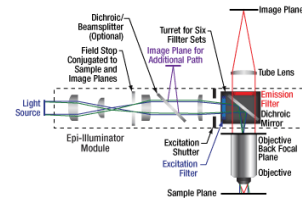
In contrast to the CSE2100 and CSE2200 (described above), the CSE2000 Epi-Illuminator Module does not include beam conditioning optics. This standalone module features four 4-40 taps for 60 mm cage systems on the back side. This mechanical interface enables Thorlabs' extensive selection of 60 mm cage components to be used to build custom epi-illumination paths. To utilize the CSE2000 with an existing microscope featuring alternate dovetails, contact Tech Support for a custom solution.

Specifications





Click for Details
 The CSE2100 (shown here) and CSE2200 Epi-Illuminator Modules provide a field stop diaphragm and conditioning optics for the main optical path as well as a side port for an additional optical path.



Click for Details
 Optical Diagram for CSE2100 or CSE2200

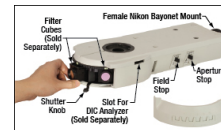
Click to Enlarge
 The CSE2100's or CSE2200's ready-to-use optical path allows an illumination source to be attached through either a D3T dovetail on a back piece, or 4-40 taps for a 60 mm cage system when the back piece is removed. The D3T dovetail can be converted to SM2 threading using the SM2A56 adapter.

Part Number	Description	Price	Availability
CSE2100	Epi-Illuminator Module with Turret for Six Filter Sets, Conditioning Optics, Additional Optical Port, WD = 50 mm	\$4,375.80	Today
CSE2200	Epi-Illuminator Module with Turret for Six Filter Sets, Conditioning Optics, Additional Optical Port, WD = 150 mm	\$4,375.80	Today
CSE2000	Epi-Illuminator Module with Turret for Six Filter Sets	\$3,052.86	Today

[Hide Epi-Illuminator Module for Up to Six Filter Cubes](#)

Epi-Illuminator Module for Up to Six Filter Cubes

- ▶ Optical Path that Accepts a Collimated Illumination Source with a Nikon Bayonet Mount
- ▶ Holds Up to Six Nikon-Compatible Filter Cubes in a Rotating Turret
- ▶ Stackable Design with Female and Male D1N Dovetails on Top and Bottom, Respectively
- ▶ Directly Compatible with WFA3110 Analyzer for DIC Imaging
- ▶ Neutral Density Filters and Shutter for Controlling the Illumination at the Sample
- ▶ Filter Cubes are Sold Separately from Epi-Illuminator Module



Click for Details
 The CSE1000 Epi-Illuminator Module has a ready-to-use beam path, with field and aperture stop diaphragms, for collimated illumination sources coupled into a Nikon bayonet mount.

The CSE1000 Epi-Illuminator Module holds a rotating six-slot filter cube turret in the epi-illumination pathway of a DIY Cerna system. With a female D1N dovetail on top and a male D1N dovetail on the bottom, it is designed to mate with the epi-illumination arm of a Cerna microscope body, with the breadboard tops sold below, as well as with other epi-illumination modules, like the WFA2001 and WFA2002 shown above. Additional details on dovetails are available in the *Microscope Dovetails* tab.

As shown by the photo to the right, the filter cube turret's slots are located behind a removable door. This turret accepts up to six TLV-TE2000 or MDFM-TE2000 Filter Cubes (sold separately), which are each retained by a detent. Having multiple filter cubes in the same epi-illumination module makes it easy to switch amongst fluorescence filter sets, beamsplitters with crossed polarizers for reflected light imaging, and mirrors.

A female Nikon bayonet mount accepts an XCITE120LED or XCITE200DC lamp. In addition, Thorlabs manufactures male Nikon bayonet mount adapters that make this epi-illumination module compatible with a high-power Solis™ microscopy LED, or another collimated illumination source coupled into our SM1 (1.035"-40) lens tubes, SM2 (2.035"-40) lens tubes, or 30 mm cage systems.

Beam conditioning optics and field and aperture stop diaphragms form a ready-to-use optical path for the epi-illumination source. Three neutral density filters (ND 4, ND 8, and ND 16), mounted on independently movable sliders, can be inserted into this optical path at the location shown in the image above. In addition, a knob opens and closes a shutter that blocks the bottom port of the epi-illumination module.

Unlike the WFA2001 and WFA2002 Epi-Illuminator Modules sold above, the CSE1000 Epi-Illuminator Module has a slot for direct compatibility with the WFA3110 DIC Analyzer.

Part Number	Description	Price	Availability
CSE1000	Epi-Illuminator Module for Up to 6 Filter Cubes, Male & Female D1N Dovetails	\$2,889.66	Lead Time

[Hide Breadboard Tops for Microscope Bodies](#)

Breadboard Tops for Microscope Bodies

- ▶ Male D1N Dovetail on Bottom for Attachment to DIY Cerna Microscope Bodies
- ▶ Available in Two Sizes in Imperial and Metric Versions:
 - ▶ Imperial: 14.00" x 11.00" or 18.00" x 4.60"
 - ▶ Metric: 350.0 mm x 275.0 mm or 450.0 mm x 116.8 mm
- ▶ 1/4"-20 or M6 x 1.0 Mounting Holes



Click to Enlarge
 Each breadboard has a male D1N dovetail on the bottom.

These black-anodized aluminum breadboard tops support user-designed widefield viewing apparatuses, epi-illumination pathways, and laser scanning pathways on top of upright Cerna microscopes. Each contains a Ø1.5" (Ø38.1 mm) through hole that is centered on a male D1N dovetail. This dovetail allows the breadboard to be connected directly to the epi-illumination arm of the microscope body, and it can also be used to stack the breadboard on top of an epi-illumination module. Additional details on the dovetail are available in the *Microscope Dovetails* tab.

The breadboards are available in two sizes. The larger version [Item # CSA3000(IM)] provides additional work surface, but protrudes past the sides of the epi-illumination arm, which may restrict approach angles around the objective for micromanipulators. The smaller version [Item # CSA3010(IM)] does not restrict approach angles and also has eight 4-40 taps around the Ø1.5" through hole for 30 mm and 60 mm cage systems.

In configurations where the breadboard is mounted directly on top of the epi-illumination arm, four M4 counterbores can be used to provide additional mounting stability.



Click for Details
 CSA3010 Used to Mount a Custom Epi-Illuminator and Widefield Viewing Apparatus



Click for Details
 CSA3000 Used to Mount a Custom Epi-Illuminator and Widefield Viewing Apparatus

Item #	CSA3000	CSA3000/M	CSA3010	CSA3010/M
Dimensions (L x W)	14.00" x 11.00"	350.0 mm x 275.0 mm	18.00" x 4.60"	450.0 mm x 116.8 mm
Breadboard Thickness	1/2"	12.7 mm	1/2"	12.7 mm
Hole Size and Spacing	1/4"-20 Tapped Holes on 1" Centers	M6 x 1.0 Tapped Holes on 25 mm Centers	1/4"-20 Tapped Holes on 1" Centers	M6 x 1.0 Tapped Holes on 25 mm Centers

Number of Tapped Holes	154	154	87	89
Cage System Compatibility	-		Four 4-40 Taps for 30 mm Cage Systems Four 4-40 Taps for 60 mm Cage Systems	
Click for Mechanical Drawing				
Dovetail	Male D1N			
Material	Matte Black Anodized Aluminum			

Part Number	Description	Price	Availability
CSA3000/M	Breadboard Top, 350.0 mm x 275.0 mm, M6 x 1.0 Taps, Male D1N Dovetail	\$695.00	Today
CSA3010/M	Breadboard Top, 450.0 mm x 116.8 mm, M6 x 1.0 Taps, Male D1N Dovetail	\$845.00	Today
CSA3000	Breadboard Top, 14.00" x 11.00", 1/4"-20 Taps, Male D1N Dovetail	\$695.00	Today
CSA3010	Breadboard Top, 18.00" x 4.60", 1/4"-20 Taps, Male D1N Dovetail	\$845.00	Today

[Hide Breadboard Top with Two-Position Slider](#)

Breadboard Top with Two-Position Slider

- ▶ Two-Position Slider to Combine or Switch Between DIY Optical Paths
- ▶ Slider has Internal SM2 Threads and Holds One 35 mm x 52 mm x 3 mm Optic
- ▶ Back Port has Internal SM2 Threads and Four 4-40 Taps for Our 60 mm Cage System
- ▶ Imperial and Metric Versions
 - ▶ OPX2400: 10.16" x 3.94" Breadboard with Double-Density 1/4"-20 Tapped Holes
 - ▶ OPX2400/M: 258 mm x 100 mm Breadboard with Double-Density M6 x 1.0 Tapped Holes
- ▶ Stackable Design with Female and Male D1N Dovetails on Top and Bottom, Respectively



Click to Enlarge
[APPLIST]
[APPLIST]

Here, a white-light illumination path has been connected to the OPX2400 using our 60 mm cage system, and a GFP fluorescence path has been mounted on top of the OPX2400 via our WFA2002 epi-illuminator module.



Click to Enlarge
Slider Located Above
Objective

The lid of the slider housing is opened by removing four cap screws with a 3 mm balldriver. The slider and the slider housing are internally SM2-threaded. Two stainless steel tracks and detents provide repeatable positioning.



Click to Enlarge
Slider Not in Optical
Path with Objective

The OPX2400(M) Breadboard

Top with Two-Position Slider adds a manually operated optic slider to the epi-illumination arm of a Cerna microscope body. By mounting a dichroic, beamsplitter, or mirror into the slider, users may combine or switch between widefield viewing, epi-illumination, and/or laser scanning pathways.

The optic slider has a clear aperture of Ø1.65" (Ø41.9 mm) and uses a leaf spring to retain a rectangular optic (minimum size: 34.9 mm x 51.9 mm x 2.8 mm; maximum size: 35.0 mm x 52.0 mm x 3.2 mm); the large aperture and optic size allow the entire aperture of the scan lenses above to be utilized. It has internal SM2 (2.035"-40) threads that face the back of the stationary housing, allowing a tube lens to be installed at a fixed distance from the dichroic. The back of the housing also has internal SM2 threads, as well as four 4-40 taps spaced for our 60 mm cage system.

In addition, a breadboard with sixty-eight 1/4"-20 (M6 x 1.0) through-tapped holes in a double-density hole pattern is included to support a home-built optical path. More 1/4"-20 (M6 x 1.0) tapped holes (sixteen on the imperial version and eighteen on the metric version) are located on the sides of the breadboard. Measured from the top of the breadboard, the beam height is 50.0 mm. Thorlabs manufactures Ø12 mm pedestal posts that center many of our 30 mm and 60 mm cage plates at this beam height, as illustrated in this photo, which provide structural support for large or heavy setups.

Thorlabs offers a 750 nm shortpass dichroic (Item # DMSP750B) and a protected silver mirror (Item # PFR14-P02) as stocked items. Beamsplitters and dichroics at additional cutoff wavelengths are available by contacting Tech Support. Once the optic is mounted, a 5/64" (2 mm) hex balldriver can be used to fine tune the optic slider's pitch and yaw adjusters. The slider may be locked in either position by tightening the included locking screw with a 3/32" balldriver. In the photo to the upper right, the locking screw is installed in the forward position.

In laser scanning Cerna systems, we recommend attaching the tube lens using the internal SM2 threads on the slider, since this will maximize the distance available along the throat depth to mount the objective and, if desired, non-descanned detectors.

Part Number	Description	Price	Availability
OPX2400/M	Breadboard Top with Slider, M6 x 1.0 Taps, Male & Female D1N Dovetails	\$4,393.14	Today
DMSP750B	35 mm x 52 mm Shortpass Dichroic Mirror, 750 nm Cutoff	\$1,020.00	Today
PFR14-P02	35 mm x 52 mm Protected Silver Mirror	\$500.00	Today
OPX2400	Breadboard Top with Slider, 1/4"-20 Taps, Male & Female D1N Dovetails	\$4,393.14	Today

[Hide OEM Microscopy Filter Cubes](#)

OEM Microscopy Filter Cubes

- ▶ MDFM-MF2: Compatible with WFA2001 and WFA2002 Epi-Illuminator Modules
- ▶ MDFM-TE2000: Compatible with CSE1000 Epi-Illuminator Module
- ▶ OEM Filter Cubes from Olympus and Nikon
- ▶ Designed for Use with Thorlabs' and Third-Party Fluorescence Filter Sets

These OEM Filter Cubes are manufactured by Olympus and Nikon. Each filter cube holds one set of fluorescence filters: an excitation filter (Ø25 mm, up to 5 mm thick), an emission filter (Ø25 mm, up to 3.5 mm thick), and a dichroic mirror (up to 25.2 mm x 36.0 mm x 1.0 mm). Optics can be mounted, aligned, and swapped out easily as illustrated in the video to the right. Each filter cube body may be disassembled for optic installation or removal using a Phillips head screwdriver. For detailed assembly instructions, please refer to the assembly manuals in the table below.

Thorlabs' Filter Cubes (sold above) are interchangeable with these OEM cubes and offer a number of design improvements, including simplified mounting and reduced dichroic mirror stress for improved imaging.

Note that many OEM filter cubes utilize plastic in their construction, while Thorlabs' filter cubes have aluminum bodies. When mixed in a filter cube turret, it is important to balance the weight. To ensure longevity of a motorized filter cube turret and prevent unnecessary wear, please place matching filter cubes opposing each other to maintain balance.

Item #	Manufacturer Part #	Microscope Manufacturer	Compatible Microscopes	Assembly Manual
MDFM-MF2	Olympus U-MF2	Olympus	AX, BX2, and IX2 Series	MDFM-MF2 Manual
		Thorlabs	Cerna Epi-Fluorescence Microscopes with WFA2001 or WFA2002 Epi-Illuminator Module	
MDFM-TE2000	Nikon TE2000	Nikon	TE2000, 50i, 55i, 80i, 90i, Eclipse Ti, and Epi-Fluor Illuminator Scopes	MDFM-TE2000 Manual
		Thorlabs	Cerna Epi-Fluorescence Microscopes with CSE1000 Epi-Illuminator Module	

Please contact Tech Support with questions regarding other cube compatibility, mounting, and filter options.

Part Number	Description	Price	Availability
MDFM-MF2	OEM Microscopy Cube Assembly for Olympus AX, BX2, IX2, and Thorlabs Cerna Microscopes with WFA2001 or WFA2002 Epi-Illuminator Module	\$493.68	Today

[Hide Turret for Six Filter Sets](#)

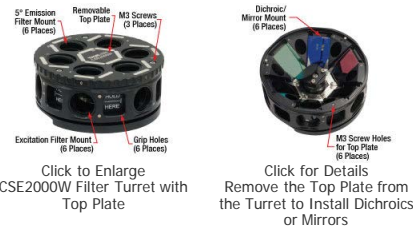
Turret for Six Filter Sets

- ▶ Removable Turret Compatible with CSE2000, CSE2100, and CSE2200 Epi-Illuminator Modules
- ▶ Easily Install Multiple Filter Sets in a Particular Configuration
- ▶ Designed for Use with Thorlabs' and Third-Party Fluorescence Filter Sets

The CSE2000W Turret allows for simple installation of up to six fluorescence filter sets, without the need for filter cubes. This turret directly accepts up to six filter sets without requiring filter cubes: six excitation filters (Ø25.4 mm, <5.1 mm in thickness), six emission filters (Ø25.4 mm, <5.1 mm in thickness), and six rectangular optics (25 mm x 36 mm, 1 ± 0.1 mm in thickness). The emission filters are mounted at a 5° angle to reduce unwanted back reflections. Having multiple filter sets in the same turret, or

multiple turrets with particular optic configurations, makes it easy to switch amongst fluorescence filter sets, beamsplitters with crossed polarizers for reflected light imaging, and mirrors. When used with the CSE2000, CSE2100, or CSE2200 epi-illumination modules (sold above), the turret position can be monitored remotely on a PC with software included with those modules.

The circular optic apertures feature internal SM1 (1.035"-40) threading for simple mounting of Ø1" optical elements; each turret ships with twelve SM1RR retaining rings, one to secure each circular filter. To install the rectangular optics, remove the top plate of the turret by loosening the three M3 screws, then remove the leaf springs to secure each optic. The turret utilizes grip holes on either side of each filter set, both for ease of use and to ensure the optical elements are not touched once installed. Once inserted into an epi-illumination module, simply turn the exposed knurled wheel to switch the filter set in the optical path.



Part Number	Description	Price	Availability
CSE2000W	Turret for Six Filter Sets	\$2,047.14	Today

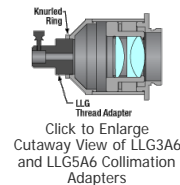
[Hide Epi-Illumination Collimation Adapters](#)

Epi-Illumination Collimation Adapters

To provide compatibility with our CSE2100, CSE2200, and CSE1000 epi-illumination modules, Thorlabs offers collimation adapters to mount onto the end of either a Ø3 mm or Ø5 mm liquid light guide (LLG). To provide even collimation of input light, the LLG3A6, LLG5A6, LLG3A7, and LLG5A7 adapters feature an optic pair of an achromatic doublet and a double convex lens, whereas the LLG3A5-A and LLG5A5-A utilize an aspheric condenser lens; see the table below for details.

The LLG is secured to the back of the collimator with a screw. The LLG3A6, LLG5A6, LLG3A7, and LLG5A7 adapters utilize a male D3T dovetail adapter, while the LLG3A5-A and LLG5A5-A use a male Nikon bayonet mount.

All adapters are calibrated such that the image plane from the LLG output is located at the back aperture of the objective when used with the compatible epi-illumination module. The LLG3A6, LLG5A6, LLG3A7, and LLG5A7 allow fine adjustment to optimize illumination for your microscope or realign the image plane via the knurled ring on the thread adapter (see image to the right).



Specifications						
Item #	LLG3A6	LLG5A6	LLG3A7	LLG5A7	LLG3A5-A	LLG5A5-A
Compatible Epi-Illuminator Module	CSE2100		CSE2200		CSE1000	
Accepted LLG Diameter	3 mm	5 mm	3 mm	5 mm	3 mm	5 mm
LLG Retention Screw	Thumbscrew				4-40 Setscrew with 0.050" Hex	
Mechanical Connection	Male D3T Dovetail				Nikon Bayonet Mount	
Effective Focal Length	40 mm		70 mm		40.00 mm ± 5%	
Collimating Optics	Achromatic Doublet & Double Convex Lens ^a				ACL5040-A Aspheric Condenser Lens	
AR Coating	350 nm - 650 nm R _{avg} < 0.5% at Each Surface				350 nm - 700 nm R _{avg} < 0.5% at Each Surface	
Transmission Graph	Click Here for Raw Data				Click Here for Raw Data ^b	
Numerical Aperture	0.3				0.554	
Magnification	Infinite				Infinite	

- a. Click for ray diagram and illumination graph. This is a theoretical simulation obtained at the objective back aperture between 365 nm and 650 nm when used with the Cerna CSE2100.
 b. Transmission data provided for the uncoated lens.

Part Number	Description	Price	Availability
LLG3A6	Ø3 mm LLG Collimating Adapter for Cerna CSE2100, ARC: 350-650 nm	\$450.00	Today
LLG5A6	Ø5 mm LLG Collimating Adapter for Cerna CSE2100, ARC: 350-650 nm	\$450.00	Today
LLG3A7	Ø3 mm LLG Collimating Adapter for Cerna CSE2200, ARC: 350-650 nm	\$450.00	Today
LLG5A7	Ø5 mm LLG Collimating Adapter for Cerna CSE2200, ARC: 350-650 nm	\$450.00	Today

[Hide Epi-Illumination Module Adapters](#)

Epi-Illumination Module Adapters

These adapters allow a collimated illumination source, such as Thorlabs' Solis™ LEDs, to attach to the epi-illumination module of a Cerna microscope. We offer the SM2A56 adapter for use with our CSE2100 epi-illuminator module, as well as adapters with a male Nikon bayonet mount for use with our CSE1000 module. See the table below for adapter attachment compatibility.

Item #	SM2A56	SM1A26	SM2A18	LED4A5	SM2A17	
Click for Details						
Compatible Epi-Illumination Module Item # (Sold Above)	CSE2100	CSE1000				
Microscope Connection	Male D3T Dovetail	Male Nikon Bayonet Mount				
Threading	External SM2 (2.035"-40)	Internal SM1 (1.035"-40)	Internal SM2 (2.035"-40)	External SM2 (2.035"-40)	External SM2 (2.035"-40)	
Cage Compatibility	-	30 mm Cage System (4-40 Tap, 4 Places)	-	-	-	
Clear Aperture	Ø1.40" (35.6 mm)	Ø0.945" (24.0 mm)	Ø1.69" (43.0 mm)	Ø1.69" (43.0 mm)	Ø1.69" (43.0 mm)	
Adapter Profile (Click for Drawing)						
Material	Stainless Steel	Black-Anodized Aluminum	Black-Anodized Aluminum	Clear-Anodized Aluminum	Black-Anodized Aluminum	

Part Number	Description	Price	Availability
SM2A56	Adapter with Male D3T Dovetail and External SM2 Threads	\$100.00	Today

[Hide Dovetail Adapters](#)

Dovetail Adapters

- ▶ Extend Versatility of Thorlabs' Lens Tube and Cage Construction Systems to DIY Cerna Systems
- ▶ WFA4111: Male D1N Dovetail and External SM2 Threads
- ▶ LCPN2: Male D1N Dovetail, Internal SM30 Threads, and 30 mm and 60 mm Cage Compatibility
- ▶ CSA1003: Female D1N Dovetail and 60 mm Cage Compatibility




These dovetail adapters integrate the D1N dovetail on the epi-illumination arm of a Cerna microscope body with Thorlabs' SM30 (M30 x 0.5) lens tubes, SM2 (2.035"-40) lens tubes, and 30 mm and 60 mm cage systems.



Click to Enlarge
 Here, the WFA4111 adapter is being used to mount an SM2 lens tube on top of an WFA2002 Epi-Illuminator Module.



Click for Details
 Here, the CSA1003 Dovetail Adapter is being used to connect a 60 mm cage system to the bottom of a WFA2002 Epi-Illuminator Module.

Item #	WFA4111	LCPN2	CSA1003
Dovetail ^a	Male D1N	Male D1N	Female D1N
Threading	Internal M38 x 0.5 ^b External SM2	Internal SM30 ^c	None ^d
Cage Compatibility	None ^d	30 mm Cage System (4-40 Tap ^e , 4 Places) 60 mm Cage System (Ø6 mm Bore, 4 Places)	60 mm Cage System (Ø6 mm Bore, 4 Places)
Clear Aperture	Ø1.47" (37.0 mm)	Ø1.10" (27.9 mm)	Ø1.50" (38.1 mm)
Adapter Profile (Click for Drawing)			
Material	Black-Anodized Aluminum		

^aAdditional information on dovetails is available in the *Microscope Dovetails* tab.

^bThis internal M38 x 0.5 threading is compatible with our SM38RR retaining rings.

^cThis internal SM30 threading is compatible with our SM30RR retaining rings. Two SM30RR retaining rings are included.

^dAn SM2-threaded cage plate can be used to convert between SM2 lens tubes and 60 mm cage systems.

^eThese tapped holes are on the opposite side of the dovetail only.

Part Number	Description	Price	Availability
WFA4111	Adapter with Male D1N Dovetail, External SM2 Threads, and Internal M38 x 0.5 Threads	\$299.88	Today
LCPN2	Nikon Eclipse or Cerna Microscope Trinocular Adapter, Male D1N Dovetail, Internal SM30 Threads, 30 and 60 mm Cage Compatibility	\$105.00	Today
CSA1003	Adapter with Female D1N Dovetail and Bores for 60 mm Cage System	\$248.88	Today

[Hide Superseded](#)

Superseded

Part Number	Description	Price	Availability
MBE74100	Nikon D-FL Epi-Illuminator for Six Filter Cubes (Filter Cubes Not Included)	\$2,860.00	Lead Time

