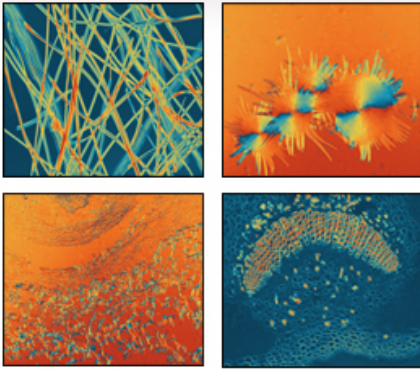
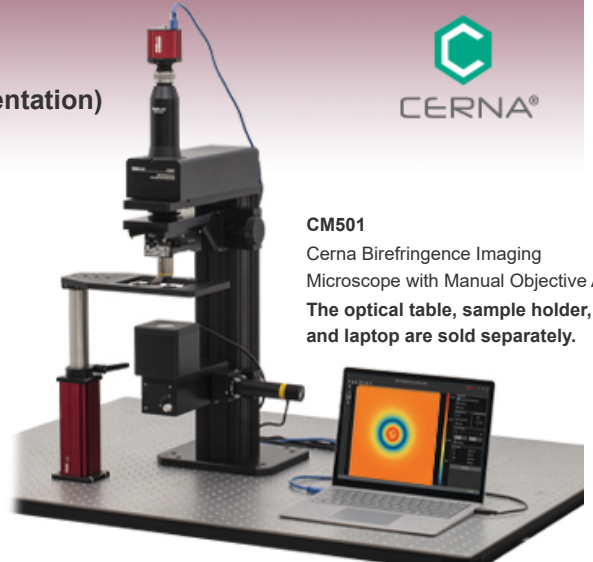


## CERNA® BIREFRINGENCE IMAGING MICROSCOPES

- ▶ Stress- and Strain-Induced Birefringence Imaging
- ▶ Raw Measurement Mode with Multiple Input Polarizations
- ▶ Measurements of Retardance and Azimuth (Fast Axis Orientation)



Sample Measurement Results Using the CM50x Software



**CM501**  
Cerna Birefringence Imaging  
Microscope with Manual Objective Arm  
The optical table, sample holder,  
and laptop are sold separately.

**Алматы** (7273)495-231  
**Ангарск** (3955)60-70-56  
**Архангельск** (8182)63-90-72  
**Астрахань** (8512)99-46-04  
**Барнаул** (3852)73-04-60  
**Белгород** (4722)40-23-64  
**Благовещенск** (4162)22-76-07  
**Брянск** (4832)59-03-52  
**Владивосток** (423)249-28-31  
**Владикавказ** (8672)28-90-48  
**Владимир** (4922)49-43-18  
**Волгоград** (844)278-03-48  
**Волгда** (8172)26-41-59  
**Воронеж** (473)204-51-73  
**Екатеринбург** (343)384-55-89

**Иваново** (4932)77-34-06  
**Ижевск** (3412)26-03-58  
**Иркутск** (395)279-98-46  
**Казань** (843)206-01-48  
**Калининград** (4012)72-03-81  
**Калуга** (4842)92-23-67  
**Кемерово** (3842)65-04-62  
**Киров** (8332)68-02-04  
**Коломна** (4966)23-41-49  
**Кострома** (4942)77-07-48  
**Краснодар** (861)203-40-90  
**Красноярск** (391)204-63-61  
**Курск** (4712)77-13-04  
**Курган** (3522)50-90-47  
**Липецк** (4742)52-20-81

**Магнитогорск** (3519)55-03-13  
**Москва** (495)268-04-70  
**Мурманск** (8152)59-64-93  
**Набережные Челны** (8552)20-53-41  
**Нижний Новгород** (831)429-08-12  
**Новокузнецк** (3843)20-46-81  
**Ноябрьск** (3496)41-32-12  
**Новосибирск** (383)227-86-73  
**Омск** (3812)21-46-40  
**Орел** (4862)44-53-42  
**Оренбург** (3532)37-68-04  
**Пенза** (8412)22-31-16  
**Петрозаводск** (8142)55-98-37  
**Псков** (8112)59-10-37  
**Пермь** (342)205-81-47

**Ростов-на-Дону** (863)308-18-15  
**Рязань** (4912)46-61-64  
**Самара** (846)206-03-16  
**Санкт-Петербург** (812)309-46-40  
**Саратов** (845)249-38-78  
**Севастополь** (8692)22-31-93  
**Саранск** (8342)22-96-24  
**Симферополь** (3652)67-13-56  
**Смоленск** (4812)29-41-54  
**Сочи** (862)225-72-31  
**Ставрополь** (8652)20-65-13  
**Сургут** (3462)77-98-35  
**Сыктывкар** (8212)25-95-17  
**Тамбов** (4752)50-40-97  
**Тверь** (4822)63-31-35

**Тольятти** (8482)63-91-07  
**Томск** (3822)98-41-53  
**Тула** (4872)33-79-87  
**Тюмень** (3452)66-21-18  
**Ульяновск** (8422)24-23-59  
**Улан-Удэ** (3012)59-97-51  
**Уфа** (347)229-48-12  
**Хабаровск** (4212)92-98-04  
**Чебоксары** (8352)28-53-07  
**Челябинск** (351)202-03-61  
**Череповец** (8202)49-02-64  
**Чита** (3022)38-34-83  
**Якутск** (4112)23-90-97  
**Ярославль** (4852)69-52-93

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Казахстан +7(7172)727-132

Киргизия +996(312)96-26-47

<https://thorlabs.nt-rt.ru/> || [tbe@nt-rt.ru](mailto:tbe@nt-rt.ru)

## Features

- Measures Sample Retardance up to a Half-Wave at 633 nm (up to 316 nm Retardance) and Azimuths (Fast Axis Orientation) up to  $\pm 90^\circ$
- Spatial Resolution of 1.055  $\mu\text{m}$  with Included 10X, 0.3 NA Objective
  - Additional Verified Accurate Objectives Sold Below
- Built-In 633 nm Light Source
- Two Configurations Available
  - Motorized Objective Arm (Microscope Item # CM502)
  - Manual Objective Arm (Microscope Item # CM501)
- Custom Operating Wavelengths Available by Contacting Tech Support



Click to Enlarge  
Side View of CM502 Microscope

## Applications

- Stress-Induced Birefringence Imaging
- Birefringence Sensitive Tissue Analysis
- Dye-Free, Label-Free Imaging
- Structural Imaging
- Pathologic Diagnosis
- Material Research
- Quality Inspection

Thorlabs' Cerna<sup>®</sup> Birefringence Imaging Microscopes are complete systems for measuring the retardance and azimuth of birefringent materials. With retardance measurements as low as  $\pm 1$  nm, azimuth measurements as small as  $\pm 1^\circ$ , spatial resolution of 1.055  $\mu\text{m}$  with the included objective, and the flexible Cerna platform, these microscopes are a versatile solution for birefringence

imaging. The CM50x microscopes are designed for use in academic research, medical diagnostics, industrial manufacturing, and product quality assurance. Since the operation is based on a liquid crystal device, there is no internal mechanical movement, leading to very stable, vibration-free operation. Please see the *Technique* tab above for details on operation and examples of application data taken with these microscopes.

The illumination wavelength of the systems offered below is 633 nm. This wavelength can be customized from 488 nm to 780 nm by contacting Tech Support. The system includes a standard objective with 10X magnification and measures retardance up to a half-wave at 633 nm (up to 316 nm retardance) and azimuths up to  $\pm 90^\circ$ . The full specifications of these microscopes are outlined in the *Specs* tab.

The microscope body is built on the flexible Cerna platform with 95 mm dovetail for easy integration with the wide range of compatible sample holders or custom modules that use our Cerna body attachments to integrate components from our large catalog of optomechanics. The CSN1202 Nosepiece incorporated into the CM50x microscopes can also hold two objectives. Please refer to the *Microscope Add-Ons* tab above for recommendations on sample holders and objectives whose accuracy has been verified for these birefringence measurements.

The CM50x microscope consists of a main microscope body, an LED illumination module, 10X Nikon objective, scientific grade CMOS camera, and either a motorized (Microscope Item # CM502) or manual (Microscope Item # CM501) focusing module. See the table to the right for a comparison the two configurations. The *Shipping List* tab above provides details on what comes with each configuration.

A Windows<sup>®</sup>-based software package is included with the birefringence imaging microscope that contains every feature needed for system control and data acquisition. To view additional information about this system's software features and sample measurement results, please refer to the *Software* tab above.

These systems can be installed by the user and detailed instructions are provided in the CM50x manual. An overview of the assembly steps is shown in the *Assembly* tab above, and the *Connections* tab highlights all system connections. An optional installation service is available for customers at additional charge. Please contact Tech Support.

For applications requiring a larger field of view, our LCC7201B Birefringence Imaging System offers the same retardance and azimuth range and accuracy, but over a  $\varnothing 20$  mm field of view, and at a lower spatial resolution of 9.77  $\mu\text{m}$ .

CM50x Configuration Comparison <sup>a</sup>		
Item #	CM502	CM501
Included Motion Controller	MCM3001	N/A
Included Objective Arm		
Item #	ZFM2020 <sup>b</sup>	ZFM1020 <sup>b</sup>
Type	Motorized	Manual
Travel Range	1" (25.4 mm)	
Resolution	Bidirectional Repeatability: 1 $\mu\text{m}$ Min. Incremental Movement: 100 nm	~ 2 mm / 30°
Recommended Objectives <sup>c</sup>	N4X-PF, N10X-PF (Included), or N20X-PF	N4X-PF or N10X-PF (Included)

- For full specifications, please see the *Specs* tab above.
- For full specifications on the ZFM1020 Manual Condenser Focusing Module and ZFM2020 Motorized Module, please see the full web presentation.
- Since high NA optics contribute residual birefringence and might impact the system accuracy, we only recommend these objectives whose accuracy we have verified.

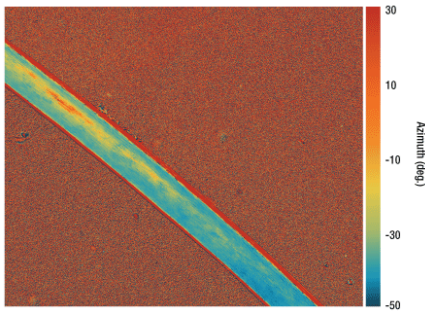
General Specifications		
Item #	CM502	CM501
Light Source Wavelength <sup>a</sup>	632.8 nm ± 1 nm <sup>b</sup>	
Microscope	Cerna <sup>®</sup> Series Microscope	
Measurement Range	Retardance	Standard Retardance Range: 0 nm to 316 nm Low Retardance Range: 0 nm to 100 nm
	Azimuth	±90°
Measurement Accuracy	Retardance	Standard Retardance Range: ±10 nm Low Retardance Range: ±1 nm
	Azimuth	Standard Retardance Range: ±3° Low Retardance Range: ±1°
Measurement Rate	<20 s (Based on Default Camera Settings)	
Field of View <sup>c</sup>	0.84 mm x 0.71 mm	
Spatial Resolution <sup>c</sup>	1.055 µm	
Interfaces	USB 2.0 and USB 3.0	
Imager Resolution	2448 x 2048 Pixels (H x V)	
Dimensions (D x W x H)	469.6 mm x 354.1 mm x 836.3 mm (18.5" x 13.9" x 32.9")	
Weight	22.4 kg (49.4 lbs)	21.9 kg (48.3 lbs)
Operating Temperature	0 °C to 40 °C	
Storage Temperature	-15 °C to 65 °C	

Scientific Camera Specifications <sup>a</sup>	
Item #	CS505MU
Sensor Type	Monochrome CMOS
Number of Active Pixels	2448 x 2048 (H x V)
Pixel Size	3.45 µm x 3.45 µm
Imaging Area	8.4456 mm x 7.0656 mm (H x V)
Host PC Interface	USB 3.0
Vertical Digital Binning <sup>a</sup>	Continuous Integer Values from 1 to 16
Horizontal Digital Binning <sup>a</sup>	Continuous Integer Values from 1 to 16
Exposure Time	0.021 ms to 7330 ms in ~0.007 ms Increments
Region of Interest (ROI)	<b>Frame Rate</b>
Full Sensor (2448 x 2048)	53.2 fps
Half Sensor (1224 x 1024)	133.7 fps
~1/10th Sensor (260 x 208)	563.2 fps
Min ROI (260 x 4)	947.3 fps

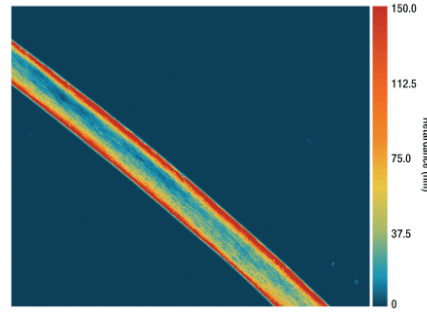
Camera Port Specifications <sup>a</sup>	
Item #	WFA4100
Magnification	1X
Dovetail	Male D1N
Tube Lens Focal Length	200 mm

Objective Specifications <sup>a</sup>	
Item #	N10X-PF

Objective Specifications <sup>a</sup>	
Magnification	10X
Numerical Aperture (NA)	0.3
Working Distance (WD)	16 mm
Parfocal Length	60 mm
Design Tube Lens Focal Length	200 mm
Coverslip Correction	0.17 mm
Barrel Diameter	30.0 mm
Length	48.7 mm
Threading	M25 x 0.75



Click to Enlarge  
2D Azimuth View of Human Hair (w.m.)



Click to Enlarge  
2D Retardance View of Human Hair (w.m.)

## SHIPPING LIST

### CM502 Cerna® Birefringence Imaging Microscope, Motorized Objective Arm

Item # CM502 consists of:

- Main CM502 Microscope Body
- Camera Assembly
- LED Assembly
- 10X Objective (Item # N10X-PF)
- Birefringent NBS 1963A Resolution Target (Item # R2L2S1B)
- 12 VDC Power Supply (Item # DS12)
- Region-Specific Power Cord
- USB Drive with Software and Manual (Not Shown)
- USB 2.0 Type-A to Type-B Cable, 2 m
- USB 3.0 A to Micro B Cable, 3 m\*
- Control Cable, 2 m
- Extra Surface Protective Tapes for Storage or Shipping (Not Shown)
- CCHK/M Metric Hex Key Set (Not Shown)
- Three-Channel Controller and Knob Box (Item # MCM3001), Including
  - Knob Box
  - Controller Box
  - Joystick Controller Cable
  - Power Supply
  - Power Cord (Region-Specific)
  - USB Cable (A to B)
  - Two 1/4"-20 Cap Screws, 1/2" Long
  - Two M6 Cap Screws, 12 mm Long
  - Six 4-40 Hex Stand-Offs to Secure Cables



Click to Enlarge  
CM502 Components

\*The microscope performance specifications provided are guaranteed only with the provided USB 3.0 cable.

### CM501 Cerna Birefringence Imaging Microscope, Manual Objective Arm

Item # CM501 consists of:

- Main CM501 Microscope Body
- Camera Assembly
- LED Assembly
- 10X Objective (Item # N10X-PF)
- Birefringent NBS 1963A Resolution Target (Item # R2L2S1B)
- 12 VDC Power Supply (Item # DS12)
- Region-Specific Power Cord
- USB Drive with Software and Manual (Not Shown)
- USB 2.0 Type-A to Type-B Cable, 2 m
- USB 3.0 A to Micro B Cable, 3 m\*
- Control Cable, 2 m
- Extra Surface Protective Tapes for Storage or Shipping (Not Shown)
- CCHK/M Metric Hex Key Set (Not Shown)



Click to Enlarge  
CM501 Components

\*The microscope performance specifications provided are guaranteed only with the provided USB 3.0 cable.

## Selected Accessories

In order to image with the CM50x Birefringence Imaging Microscopes, it is necessary to add a sample holder. To that end, we have ensured that Cerna® microscopes are compatible with a wide range of accessories. The information below compares some suggested Cerna-compatible components. For a comprehensive list of sample holders, please see our Sample Holders for DIY Cerna Systems.

The CSN1202 Nosepiece incorporated into the CM50x microscopes can hold two objectives. The systems come with an N10X-PF objective. Additional verified compatible objectives are listed below.


### Content

- Verified Objectives
- Sample Holders

## Verified Objectives

- CM50x Imaging Systems Directly Accept M25 x 0.75-Threaded Objectives (Nikon)
- Unverified Objectives Not Recommended

The CSN1202 nosepiece can hold two objectives with M25 x 0.75 threads, commonly used by Nikon objectives. One N10X-PF 10X, 0.3 NA objective is included with each CM50x microscope. Since high-NA optics contribute residual birefringence and might impact the system accuracy, we verified three widefield Nikon objectives, shown in the table to the right, to ensure that the system accuracy can still be guaranteed while switching the objectives. Unverified objectives may result in loss of measurement accuracy and are not recommended.

Item #	N4X-PF	N10X-PF	N20X-PF
<b>Photo</b> (Click to Enlarge)			
<b>Objective Class</b>	Plan Fluorite		
<b>Magnification<sup>a</sup></b>	4X	10X	20X
<b>Numerical Aperture (NA)</b>	0.13	0.3	0.50
<b>Working Distance (WD)</b>	17.2 mm	16 mm	2.1 mm
<b>Parfocal Length</b>	60 mm		
<b>Threading</b>	M25 x 0.75		

- When Used with the Design Tube Lens Focal Length of 200 mm

Please note that objectives with a magnification greater than 10X are not recommended for use with the CM501 Microscope with Manual Objective Arm, as the focusing resolution is not sufficient for these higher NA objectives.

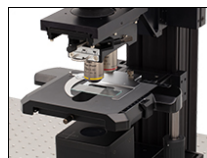
**Please Note:** Unverified objectives may lead to inaccurate birefringence measurements due to residual birefringence of the objectives. For applications requiring objectives outside those recommended here, please contact Tech Support to discuss your imaging needs.

## Sample Holders

- Rigid Stands Hold Samples Underneath and Around the Objective
  - Designed for Slides, Petri Dishes, Well Plates, Recording Chambers, Micromanipulators, and Custom Inserts
  - Motorized and Manual Translation Stages with X and Y Travel Available
- Fixed Arms to Incorporate Fast XY Stage, Manual XY Stage, Lens Tubes, and/or Cage Systems to be Placed Directly into Optical Path
  - CSA1000: For Our MLS203-1 Fast XY Scanning Stage
  - CSA1051: For CSS2001 Olympus Manual Stage
  - CSA1001: For Ø1" Lens Tubes and 30 mm Cage Systems
  - CSA1002: For Ø2" Lens Tubes and 60 mm Cage Systems



Click to Enlarge  
MLS203-1 Stage with  
MLS203P2 Slide Holder on  
CSA1000 Fixed Arm



Click to Enlarge  
CM502 Microscope with CSA1051  
Adapter Arm, CSS2001 Manual  
XY Stage, and CS2000 Slide  
Holder



Click for Details  
CM501 Microscope with  
MLS203P2 Slide Holder,  
MPRM(/M) Rectangular Insert  
Holder, MPP20 Post, and  
LPH200 Post Holder

Thorlabs offers highly configurable solutions for mounting your sample beneath the objective of the Cerna microscope. Rigid stands are available with multiple platform styles that can accept slides, petri dishes, recording chambers, micromanipulators, and custom inserts. The included collar makes them lockable at a height and angle chosen by the user. An example rigid stand is shown at the right integrated with the CM501 Microscope. We also offer translation stages for these rigid stands that provide motorized horizontal translation of the sample.

Our fixed arms attach directly to the dovetail that spans the height of the microscope body, allowing them to be positioned anywhere along the body height, putting the sample directly into the microscope's optical path, and taking advantage of the existing footprint of the scope. For a pre-configured motorized sample holder solution, use the CSA1000 Fixed Arm with the MLS203-1 Fast XY Scanning Stage (shown in the left-most image above). This stage is compatible with our MZS500-E Piezo-Driven Insert, which adds high-resolution Z-axis adjustments. The CSA1051 Adapter Arm, paired with the CSS2001 Olympus Manual Stage and CSS2000 Olympus Slide Holder, provides a manual XY solution, shown in the center image above. Alternatively, the CSA1001 and CSA1002 Fixed Arms are compatible with Thorlabs' extensive selection of optomechanical components, allowing custom sample holder configurations to be integrated with this microscope.

Several compatible options are outlined in the tables below. For a comprehensive list of options, please see our Sample Holders for DIY Cerna Systems.

### Rigid Stands



[Click to Enlarge](#)

#### MPRM(/M) Rectangular Insert Holder, MPP20 Post, and LPH200 Post Holder

- ▶ Designed for Multiple Slides, Petri Dishes, Well Plates, Breadboards, Our MZS500-E Z-Axis Piezo Stage, and User-Designed Inserts
- ▶ Height Range: 248.1 - 410.1 mm
- ▶ Other Heights Available



[Click to Enlarge](#)

#### MPRC(/M) Recording Chamber Holder, MPP25 Post, and LPH250 Post Holder

- ▶ Insert Designed for Recording Chambers
- ▶ Height Range: 301.3 - 514.2 mm
- ▶ Other Heights Available



[Click to Enlarge](#)

#### MP20(/M) Rigid Stand with Platform

- ▶ 24 1/4"-20 (M6 x 1.0) Tapped Holes for Holding Micromanipulators or Other Equipment
- ▶ Height Range: 248.1 - 410.1 mm
- ▶ Other Heights Available

### Fixed Arms



[Click to Enlarge](#)

#### CSA1000 Fixed Arm

- ▶ Accepts MLS203-1 Fast XY Scanning Stage



[Click to Enlarge](#)

#### CSA1051 Adapter Arm

- ▶ Compatible with CSS2001 Olympus U-SV Manual XY Stage



[Click to Enlarge](#)

#### CSA1001 Fixed Arm

- ▶ Compatible with Ø1" Lens Tubes and 30 mm Cage Systems



[Click to Enlarge](#)

#### CSA1002 Fixed Arm

- ▶ Compatible with Ø2" Lens Tubes and 60 mm Cage Systems

## CM50x Microscope Connections



Click to Enlarge  
CM50x Control Box Connection



Click to Enlarge  
CM50x Camera Connections



Click to Enlarge  
CM50x Main Body Connections

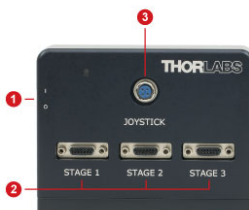
Control Box Connection	
Callout	Description
1	Control Cable Connection (to Main Body)

Microscope Main Body Connections	
Callout	Description
1	Control Cable Connection (to Control Box)
2	Service Switch (for Technical Support Only)
3	USB 2.0 Type B Connector (to Computer)
4	LED Connector
5	Power Supply Connector
6	Power Switch

Camera Connections	
Callout	Description
1	USB 3.0 Micro B Connector (to Computer) <sup>a</sup>
2	12 Pin Hirose Female Connector (Not Used)
3	Status LED

- The microscope performance specifications (see the *Specs* tab) are guaranteed only with the provided USB 3.0 cable.

## CM502 Motorized Arm Controller Connections



Click to Enlarge  
MCM3001 Controller Front Panel



Click to Enlarge  
MCM3001 Controller Back Panel

MCM3001 Controller Back Panel	
Callout	Description
1	USB 2.0 Type B Port for Computer Connection <sup>a</sup>
2	Power Supply Connector

- Controller can optionally be driven with separate, downloadable software. Please see the *Software* tab on the full web presentation for details.

MCM3001 Controller Front Panel	
Callout	Description
1	Power Switch on Side

MCM3001 Controller Front Panel	
2	Micro-D 15 Pin Female Stage Connectors <sup>a</sup>
3	MC3001 Joystick Connection

- Please see the Pin Diagram tab on the full web presentation for pin details.

## SOFTWARE

The Cerna<sup>®</sup> Birefringence Imaging Microscopes include a Windows<sup>®</sup>-based software package with every feature needed for system control and data acquisition. Please click the Software button to the right to download the latest software for this system.

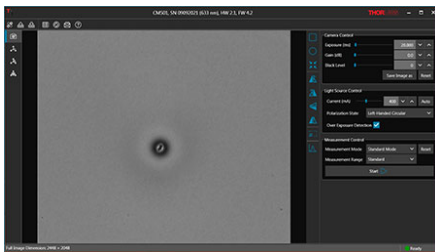
### Features

- Standard and Low Noise Modes for Retardance and Azimuth Measurements
- Raw Sample Mode for Intensity Measurement
- Selectable Rectangular or Circular Region of Interest (ROI)
- Adjustable Dynamic Camera Settings (Gain, Exposure Time, Black Levels)
- Overexposure Detection
- Auto Adjustment of Light Source Level
- 1D, 2D, and 3D Measurement Result Displays
- Data Output in Binary, CSV, and Image (PNG and TIFF) Formats

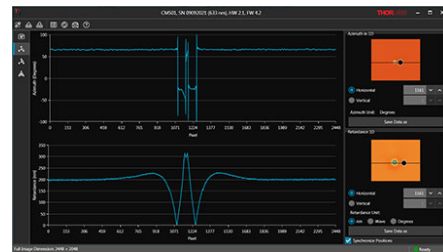
The software includes three modes: Standard Mode and Low-Noise Mode, which are used to measure a sample's retardance and azimuth, and Raw Sample Mode, which is used to measure intensity with different input polarizations. Standard and Raw Sample Modes provide a higher measurement rate with a lower signal-to-noise ratio, while Low Noise Mode provides a lower measurement rate with a higher signal-to-noise ratio. An exposure time of 300 ms is set as the default, which allows a measurement to be finished within 20 seconds in Standard Mode and 4 minutes in Low Noise Mode.

The standard and low-noise modes provide two ranges of measurement accuracy: Standard Retardance Range and Low Retardance Range. Standard Retardance provides a measurement accuracy of  $\pm 10$  nm for retardances in the 0 nm to 316 nm range and  $\pm 3^\circ$  for azimuths over the entire measurement range. Low Retardance Range will improve the measurement accuracy to  $\pm 1$  nm for retardances in the 0 nm to 100 nm range and  $\pm 1^\circ$  for azimuths over the entire measurement range. The minimum exposure time is 0.021 ms, and the maximum exposure time is 7330 ms.

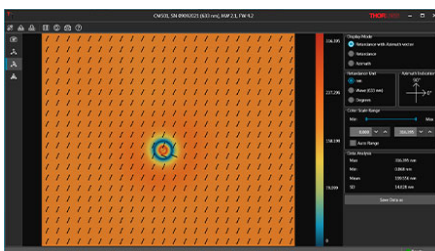
Below are screenshots from the included user interface, showing the different measurement display modes available. The Preview, 1D, 2D, and 3D views are all of a liquid crystal polymer zero-order half wave plate (Item # WPH10E-830).



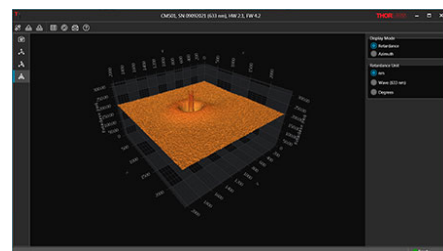
Click to Enlarge  
Camera Preview



Click to Enlarge  
Azimuth and Retardance 1D View



Click to Enlarge  
Retardance with Azimuth Vector 2D View



Click to Enlarge  
Retardance 3D View

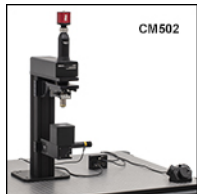
## Software

### Version 2.1.3

Click the button below to visit the Cerna Birefringence Imaging Microscope software page.



## Birefringence Imaging Microscope with Motorized Objective Arm



- ▶ Appropriate for Full Range of Verified Objectives (See *Microscope Add-Ons* Tab)
- ▶ Two Free Channels Can Be Used to Control User-Supplied PLS-X or PLS-XY Stages (Not Included)

The CM502 Birefringence Imaging Microscope with Motorized Objective Arm incorporates our ZFM2020 Motorized Focusing Module to provide 1" of fine, variable-speed travel along the Z axis for focusing the system. Some key specifications for this module are shown in the table below. The fine Z-axis control allows this microscope to be used with higher resolution objectives (not included). Since high NA optics contribute residual birefringence and might impact the system accuracy, we only recommend objectives whose accuracy we have verified. For a list of verified objectives, please see the *Microscope Add-Ons* tab above.



Click to Enlarge  
[APPLIST]  
[APPLIST]  
CM502 Microscope with Motorized XY Stage and Sample Holder

ZFM2020 Motorized Translation Stage Specifications <sup>a</sup>	
Travel Range	1" (25.4 mm)
Bidirectional Repeatability	5 μm
Backlash	10 μm
Minimum Achievable Incremental Movement	424 nm
Minimum Achievable Repeatable Movement	1.06 μm
Velocity (Max)	7 mm/s
Acceleration (Max)	11 mm/s <sup>2</sup>

- For full specifications on the ZFM2020 Manual Condenser Focusing Module, please see the full web presentation.

The MCM3001 Three-Channel Controller is included with the CM502 microscope for control of the motorized focusing module. Because the microscope only requires one channel of motion control, the MCM3001 controller can also be used to control additional motion control components (not included). For example, the PLS-XY Translation Stage can be incorporated with a rigid stand and sample holder, to provide a full XYZ motorized adjustment microscope system. The image at the right shows the CM502 system used with a PLS-XY stage, a rigid stand and an MLS203P2 Slide Holder. The rigid stand is constructed with an MPRM(M) Insert Holder mounted on an MPP20 Post, supported by the LPH200 Rigid Stand Post Holder.

More examples of recommended sample holders are listed in the *Microscope Add-Ons* tab above. For a comprehensive list of options, please see our Sample Holders for DIY Cerna Systems.

Part Number	Description
CM502	Customer Inspired! Cerna Birefringence Imaging Microscope, Motorized Objective Arm

## Birefringence Imaging Microscope with Manual Objective Arm



- ▶ Coarse Focusing Adjustment Appropriate for Lower Resolution Imaging
- ▶ Appropriate for Use with 10X Objective (Included) or 4X Verified Objective (Sold Separately Below)
- ▶ Provides Manual Focusing Adjustment over 1" Travel Range

The CM501 Birefringence Imaging Microscope with Manual Objective Arm incorporates our ZFM1020 Manual Condenser Focusing Module to provide 1" of coarse adjustment along the Z axis for focusing the objective. This focusing module is controlled manually with approximately 2 mm of Z movement per 30° of rotation of the manual knob. For full specifications on the ZFM1020 Manual Condenser Focusing Module, please see the full web presentation. The CM501 microscope is appropriate for wider field of view imaging with lower resolution. We recommend this microscope for use with the included 10X objective as well as lower magnifications, such as the N4X-PF Imaging Objective.

Manual Focusing Module Specifications <sup>a</sup>	
Travel Range	1" (25.4 mm)
Distance per Degree Turn of Focus Knob <sup>b</sup>	~2 mm / 30°

- For full specifications on the ZFM1020 Manual Condenser Focusing Module, please see the full web presentation.
- The angular distance between each groove on the focus knob is 30°.

A full microscope system requires a sample holder. An example configuration is shown at the right. The CM501 microscope is incorporated with an MLS203P2 Slide Holder, on an MPRM(M) Insert Holder attached to an MPP20 Post. This post is supported by the LPH200 Rigid Stand which is in turn mounted on XR25P(M) and XR25C(M) Linear Translation Stages, for full manual XYZ control. A manually controlled system provides a cost-effective, full birefringence imaging system for

lower resolution applications. The addition of a motorized sample stage in Z can also be used to make the CM501 microscope appropriate for higher resolution applications.

More examples of recommended sample holders and stages are listed in the *Microscope Add-Ons* tab above. For a comprehensive list of options, please see our Sample Holders for DIY Cerna Systems.



Click to Enlarge  
[APPLIST]  
[APPLIST]  
CM501 Microscope with Manual XY Stage and Sample Holder

Part Number	Description
CM501	Customer Inspired! Cerna Birefringence Imaging Microscope, Manual Objective Arm

## Verified Nikon Plan Fluorite Objectives

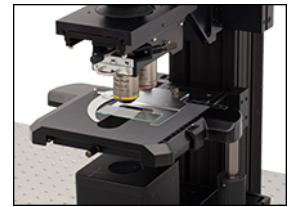


- ▶ Infinity-Corrected Plan Fluorite Design
- ▶ Verified for Use with CM50x Birefringence Imaging Microscopes
- ▶ M25 x 0.75 Threading
- ▶ Designed for a Tube Lens Focal Length of 200 mm
- ▶ 60 mm Parfocal Length

The Nikon Plan Fluorite Objectives sold on this page provide 4X or 20X magnification.

They are designed to have high transmission in the UV to NIR wavelength range and to produce flat images across the field of view. Objectives here have been verified to provide accurate results when used with the CM50x microscopes.

These multi-purpose objectives can also be utilized for brightfield microscopy, fluorescence microscopy, and polarization-sensitive observations. The N20X-PF objective is also good for both darkfield and DIC microscopy.



Click to Enlarge  
[APPLIST]  
CM502 Microscope with Additional 4X  
Objective and Manual XY Sample Stage

Each objective is designed for use with a tube lens focal length of 200 mm and is compatible with our DIY Cerna® Systems. They use M25 x 0.75 threading; to use these objectives with a different thread standard, please see our microscope objective thread adapters.

These objectives are designed for use from -18 °C (0 °F) to 60 °C (140 °F) and are not recommended for use at extreme temperatures.

Item #	Wavelength Range	M <sup>a</sup>	WD	EFL	NA	EP <sup>b</sup>	Resolution <sup>c</sup>	PFL	Cover Glass Thickness	Objective Threading
N4X-PF	UV to NIR	4X	17.2 mm	50 mm	0.13	13 mm	2.6 μm	60 mm	0 - 0.17 mm	M25 x 0.75; 3.6 mm Depth
N20X-PF		20X	2.1 mm	10 mm	0.50	10 mm	0.7 μm		0.17 mm	M25 x 0.75; 5 mm Depth

- When Used with a 200 mm Focal Length Tube Lens
- Entrance pupil diameter (EP) is defined at the back aperture of the objective and calculated as EP=2\*NA\*EFL.
- The theoretical Rayleigh Resolution is determined by  $0.61 \cdot \lambda / NA$  at  $\lambda = 550 \text{ nm}$ ; see the *Resolution* tab for details.

M = Magnification  
WD = Working Distance  
EFL = Effective Focal Length  
NA = Numerical Aperture

EP = Entrance Pupil Diameter

OFN = Optical Field Number

PFL = Parfocal Length

Part Number	Description
N20X-PF	20X Nikon Plan Fluorite Imaging Objective, 0.50 NA, 2.1 mm WD
N4X-PF	4X Nikon Plan Fluorite Imaging Objective, 0.13 NA, 17.2 mm WD

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