MCM3002 - November 7, 2024

Item # MCM3002 was discontinued on Novermber 7, 2024. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

COMPACT CONTROLLERS FOR MICROSCOPY

- Operate Motorized Microscopy Stages and Components
- 7.0 A Peak Current Output
- Three Channel Control via Software or Three-Knob Joystick

MCM3002
Compact Controller for Microscopy

Controller Box

3-Knob Joystick

MCM301
Compact Controller for Motorized Rigid Stands and PLS Series Stages

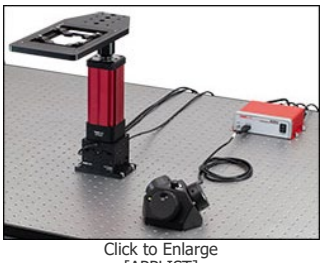
MCM3002 Used to Control the Cerna® Translating Platform

[Hide Overview]

OVERVIEW

Features

- Operate Motorized Microscopy Stages and Components
- Control up to Three Channels at Once
  - MCMK3 Three-Knob Joystick Available Separately for Use with MCM301 Controller
  - MCM3002 Controller Includes Three-Knob Joystick for Hand-Operated Control
- Each Axis can be Individually Disabled to Prevent Unintended Movements or to Retain a Position
  - Feature Available through Software or Three-Knob Joystick
- Dial on top of Three-Knob Joystick Adjusts Translation Speed
- Remotely Control Translation Using Standalone Software



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[APPLIST]
[APPLIST]
MCM301 Controller and MCMK3 Three-Knob Joystick Used to Control Both Axes of the PLSXY Translation Stage and One-Axis MPM250 Motorized Rigid Stand

Thorlabs offers a series of compact controllers to operate motorized microscopy stages and components. The MCM301 Controller is compatible with the MCMK3 Three-Knob Joystick (not included) for hand-operation. The MCM3002 Controller includes both a hand-operated three-knob joystick and a controller box. Each controller is designed to operate different stages: the MCM301 controller is compatible with the MPM250(/M) motorized rigid stand and PLS series translation stages, and the MCM3002 controller is compatible with motorized Cerna components with a travel range of 2" (see the table below). The MCM301 controller supports plug-and-play operation, automatically detecting compatible stages that are connected to it, while the MCM3002 controller requires manual stage selection in its related software.

Each side face of the three-knob joystick includes a rotating knob and a push-button switch that are dedicated to a single channel. The push-button switch enables and disables the channel, and is lit in green when the channel is enabled. Disabling the channel lets the user preserve a position or prevent accidental movements. A dial on the top face adjusts the velocity per rotation of the knob (see the *Specs* tab for details).

Since each controller has three channels, you only need to purchase enough channels for each of the modules you intend to drive. For example, an MPM250 Vertical Rigid Stand (which has one axis) mounted on a PLSXY Translation Stage (two axes) would only require one MCM301 controller.

Axis translation can also be adjusted remotely via software for all controllers (see the *Software* tab for details). Alternatively, a LabVIEW™ software development kit (SDK) for the MCM3002 controller; a LabVIEW™, C++, and Python SDK for the MCM301 controller; and support documentation are available to integrate these controllers with custom imaging software.

Item #	MCM301	MCM3002
Compatible Stages	MPM250(/M) Motorized Rigid Stand PLSX & PLSXY Translation Stages for Rigid Stands PLSZ Motorized Focusing Module	PMP-2XY(/M) Translating Platform MMP-2XY Microscope Body Translator

[Hide Specs]

SPECS

Item #	MCM301	MCM3002
Motor Output		
Motor Drive Voltage	24 V	
Motor Drive Current	7.0 A (Peak) 3.0 A (RMS)	
Motor Drive Type	12-Bit PWM Control	
Control Algorithm	Open/Closed-Loop Microstepping	Open-Loop Microstepping
Stepping	128 Microsteps per Full Step	128 Microsteps per Full Step
Encoder Resolution	-	0.5 µm
Total Steps per Revolution	-	25 600
Maximum Stepping Velocity	-	793 steps/s
Position Feedback	Quadrature Encoder (QEP) Input 5 V	
Encoder Feedback Bandwidth	1 MHz	16 MHz
Position Counter	32 Bit	
Operating Modes	Position and Velocity	
Velocity Profile	Trapezoid	
Motor Drive Connector		
Mechanical Specifications	15 Position D-Type, Female Pin Connector	15 Position D-Type, Micro-D Plug, Male Pin Connector
Motor Drive Outputs	Phase A and B	200
Quadrature Encoder (QEP) Input	Single Ended	
Limit Switch Inputs	Forward, Reverse (+ Common Return)	Forward, Reverse, Index
Encoder Supply	5 V	
Input Power Requirements		
Voltage	24 VDC	
Current	6.67 A	3.75 A (Peak)
General		
Computer Connection	USB 2.0	
Housing Dimensions (W x D x H)	5.91" x 4.52" x 1.91" (150.0 mm x 114.8 mm x 48.5 mm)	97.3 mm x 50.8 mm x 73.6 mm (3.83" x 2.00" x 2.90")

Compatible Motor Specifications	
Motor Type	2-Phase Bi-Polar Stepper
Rated Phase Current	Up to 7 A Peak
Coil Resistance (Nominal)	5 to 20 Ω
Position Control	Open or Closed Loop

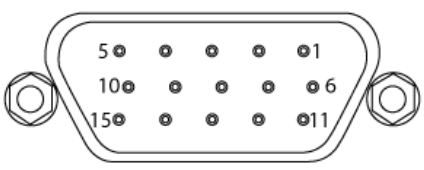
Compatible Stages	
MCM301	MPM250(/M) Motorized Vertical Rigid Stand
	PLSX & PLSXY Translation Stages for Rigid Stands
	PLSZ Motorized Focusing Module
MCM3002	MMP-2XY Microscope Body Translator
	PMP-2XY(/M) Translating Platform

Hide Pin Diagrams

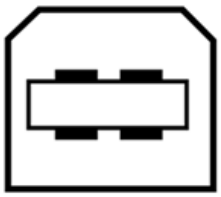
PIN DIAGRAMS

MCM301

Adapter Cable Connector for Motor Drive
D-Sub 15 Pin Female



Computer Connection
USB 2.0 Type B

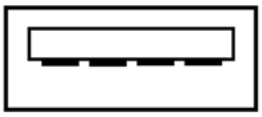


USB Type B to Type A Cable Included

Pin	Description	Pin	Description

1	Ground	9	Stage Identification
2	Reverse Limit Search	10	5 V
3	Forward Limit Search	11	Encoder, A
4	Motor Phase B-	12	Reserved for Future Use
5	Motor Phase B+	13	Encoder, B
6	Motor Phase A-	14	Reserved for Future Use
7	Motor Phase A+	15	Reserved for Future Use
8	Reserved for Future Use	-	-

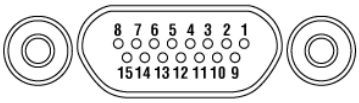
Joystick Connection
USB 2.0 Type A



USB Type A Cable Attached to MCMK3 Joystick

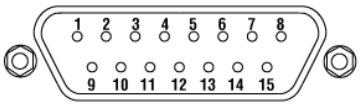
MCM3002

Adapter Cable Connector for Controller I/O Micro-D 15 Pin Female



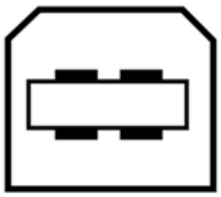
Pin	Description
1	Stepper Motor Phase A+
2	Stepper Motor Phase A-
3	Not Used
4	Not Used
5	5 V
6	Ground
7	UL
8	Encoder Phase B+
9	Stepper Motor Phase B+
10	Stepper Motor Phase B-
11	Not Used
12	Ground
13	5 V
14	LL
15	Encoder Phase A+

Adapter Cable Connector for Motor Drive D-Sub 15 Pin Male



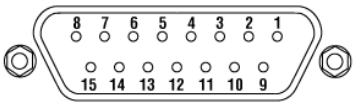
Pin	Description
1-6	Not Used
7	Stepper Motor Phase A+
8	Stepper Motor Phase B+
9-13	Not Used
14	Stepper Motor Phase A-
15	Stepper Motor Phase B-

Computer Connection
USB 2.0 Type B



USB Type B to Type A Cable Included

Adapter Cable Connector for Encoder Drive D-Sub 15 Pin Female



Pin	Description
1	Not Used
2	Ground
3	Not Used
4	Not Used
5	Encoder Phase B-
6	Encoder Phase A-
7	5 V
8	5 V
9	Ground
10	LL
11	UL
12	Not Used
13	Encoder Phase B+
14	Encoder Phase A+
15	Not Used

Hide Software

SOFTWARE

MCM301 Software

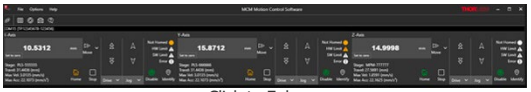
Links to the latest verions of the MCM301 controller software and firmware are below. The software download page includes a GUI, drivers, and a LabView™/C++/Python software development kit (SDK) for third-party development support.

Software

Version 1.1 (May 24, 2024)

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

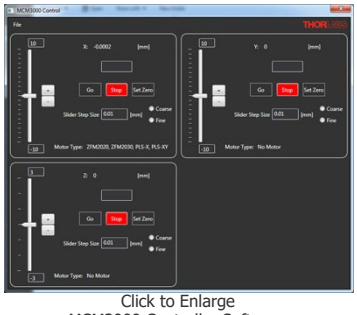
Software



Click to Enlarge
MCM301 Controller Software

MCM3000 Series Software

Links to the latest versions of the MCM3000 series controllers software and firmware are below. The software download page offers a link to the GUI interface and driver. In addition, we provide a LabVIEW™ software development kit (SDK) and support documentation to allow any of the controllers to be controlled using custom imaging software.



Click to Enlarge
MCM3000 Controller Software

Software

Version 4.0 (August 8, 2019)

The software package contains the installation files for the GUI interface, driver, SDK, and support documentation. The software is compatible with Windows® 7 and 10 (64-bit) systems.

Software

Firmware Update

Version 1.3 (August 8, 2019)

The latest firmware version for the MCM3000 Series Controllers. For installation instructions, consult the User's manual.

Firmware Updates

Hide Shipping List

SHIPPING LIST

Click to Enlarge
MCM301 Contents

Each MCM301 includes the following:

- Controller Box
- Power Supply, with Location-Specific Power Cord
- USB Cable (A to B)

Note: The MCM301 does not include a knob box. A compatible MCMK3 three-knob joystick is available separately.

Click to Enlarge
MCM3002 Contents

Each MCM3002 includes the following:

- Knob Box
- Controller Box, with Joystick Controller Cable
- Power Supply, with Location-Specific Power Cord
- Three Motor Adapter Cables for Cerna® Microscope Body Translator and Translating Platforms
- USB Cable (A to B)
- Two 1/4"-20 Cap Screws, 1/2" Long
- Two M6 Cap Screws, 12 mm Long
- Twelve 4-40 Hex Stand-Offs to Secure Cables Out

Hide Microscope Guide

MICROSCOPE GUIDE

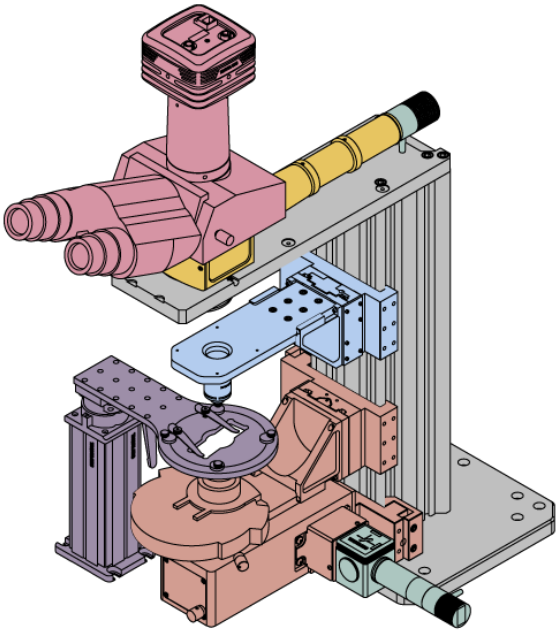
Elements of a Microscope

This overview was developed to provide a general

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

understanding of a Cerna® microscope. Click on the different portions of the microscope graphic to the right or use the links below to learn how a Cerna microscope visualizes a sample.

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



Terminology

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

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

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

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

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

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

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

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

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

Optical Path: The path light follows through the microscope.

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

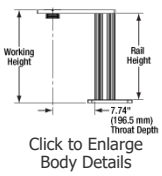
Throat Depth: The distance from the vertical portion of the optical path to the edge of the support rail of the microscope body. The size of the throat depth, along with the working height, determine the working space available for microscopy.

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

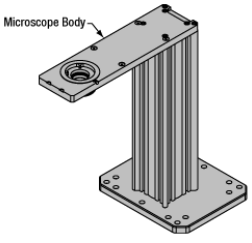
Working Height: The height of the support rail of the microscope body plus the height of the base. The size of the working height, along with the throat depth, determine the working space available for microscopy.

Microscope Body

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



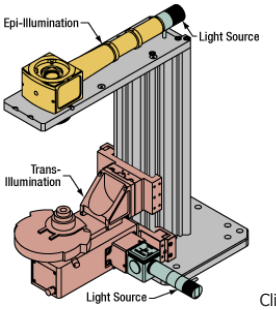
Click to Enlarge
Body Details



Click to Enlarge
Cerna Microscope Body

Microscope Bodies	Microscope Translator

Illumination



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

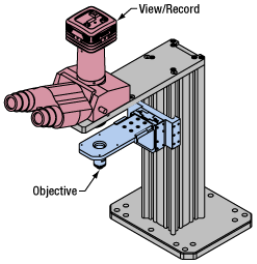
Using the Cerna microscope body, a sample can be illuminated in two directions: from above (epi-illumination, see yellow components to the right) or from below (trans-illumination, see orange components to the right).

Epi-illumination illuminates on the same side of the sample as the viewing apparatus; therefore, the light from the illumination source (green) and the light from the sample plane share a portion of the optical path. It is used in fluorescence, confocal, and reflected light microscopy. Epi-illumination modules, which direct and condition light along the optical path, are attached to the epi-illumination arm of the microscope body via a circular D1N dovetail (see the *Microscope Dovetails* tab or here for details). Multiple epi-illumination modules are available, as well as breadboard tops, which have regularly spaced tapped holes for custom designs.

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

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

Sample Viewing/Recording



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

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).

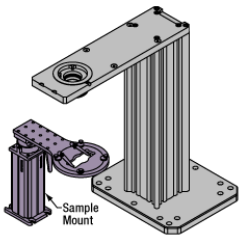
Objectives & Accessories	Objective Mounting

Sample Viewing	Cameras	PMTs	Breadboards & Body Attachments

Sample/Experiment Mounting

Various sample and equipment mounting options are available to take advantage of the large working space of this microscope system. Large samples and ancillary equipment can be mounted via mounting platforms, which fit around the microscope body and utilize a breadboard design with regularly spaced tapped through holes. Small samples can be mounted on rigid stands (for example, see the purple component to the right), which have holders for different methods of sample preparation and data collection, such as slides, well plates, and petri dishes. For more traditional sample mounting, slides can also be mounted directly onto the microscope body via a manual XY stage. The rigid

stands can translate by way of motorized stages (sold separately), while the mounting platforms contain built-in mechanics for motorized or manual translation. Rigid stands can also be mounted on top of the mounting platforms for independent and synchronized movement of multiple instruments, if you are interested in performing experiments simultaneously during microscopy.



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

Close

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

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

Product Families & Web Presentations

Sample Viewing

Breadboards & Body Attachments

Cameras

PMTs

Close

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

Product Families & Web Presentations

Objectives

Objective Thread Adapters

Parfocal Length Extender

Piezo Objective Scanner

Objective Mounting

Close

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

Product Families & Web Presentations

Translating Platforms

Rigid Stands

Translation Stages for Rigid Stands

Motorized XY Stages

Manual XY Stage

Close

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

Product Families & Web Presentations

Trans-Illumination Kits

Solis™ High-Power LEDs

Mounted LEDs

X-Cite® Lamps

Other Light Sources

Close

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

Product Families & Web Presentations

Epi-Illumination

Body Attachments

Light Sources

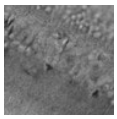
Close

Trans-illumination illuminates from the opposite side of the sample as the viewing apparatus. Example imaging modalities include brightfield, differential interference contrast (DIC), 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 Compact Controller for Motorized Rigid Stands and PLS Series Stages]

Compact Controller for Motorized Rigid Stands and PLS Series Stages

- Designed for Motorized Rigid Stands, Rigid Stand Translation Stages, and Motorized Focusing Modules
- Provides Control for up to Three Channels
  - Separately Available Three-Knob Joystick Allows Hand Operation
- Each Axis can be Individually Disabled to Prevent Unintended Movements or to Retain a Position
  - Accomplished via Software or MCMK3 Three-Knob Joystick
- Dial on top of Three-Knob Joystick Adjusts Translation Speed
- Remotely Control Translation Using Standalone Software (Requires 64-Bit Windows® 7 or Later)

Click for Details
Controller Front View
(Click for Back View)

The MCM301 3-Axis Controller consists of a controller box; a compatible USB three-knob joystick is available separately for hand operation. Stages can be controlled independently using standalone software. The MCM301 is designed to operate the MPM250(/M) vertical rigid stand, the PLSX and PLSXY translation stages for rigid stands, and the PLSZ focusing module. Each stage will be automatically detected when connected to the MCM301 controller, allowing for plug-and-play operation. An interlock circuit is included, with the interlock jack located on the front panel of the controller. Additionally, the included DS24 power supply is also available separately if a replacement is needed.

When using the optional MCMK3 three-knob joystick, each side face of the joystick includes a rotating knob and a push-button switch that are dedicated to a single axis. The push-button switch on the three-knob joystick enables and disables the axis and is lit in green when the axis is enabled. Disabling the axis lets the user preserve a position or prevent accidental movements. A dial on the top face of the three-knob joystick adjusts the velocity per rotation of the knob. For more information on the MCMK3 three-knob joystick and how to utilize the USB HID protocol, please see the full web presentation. Note that the MCMK3 three-knob

joystick is the only joystick compatible with the MCM301 controller.

Since each MCM301 controller has three channels, you only need to purchase enough channels for each of the modules you intend to drive. For example, an MPM250 Vertical Rigid Stand (which has one axis) and a PLSXY Translation Stage (two axes) would only require one MCM301 controller.

Axis translation can also be adjusted remotely via software (see the *Software* tab for details). Alternatively, a LabVIEW™, C++, and Python software development kit (SDK) and support documentation are available to integrate these controllers with custom imaging software.

Part Number	Description	Price	Availability
MCM301	Three-Channel Controller for Motorized Rigid Stands and PLS Series Stages	$1,581.00	Today
MCMK3	Customer Inspired! 3-Knob USB HID Joystick	$1,181.77	Today

Hide Compact Controllers for Focusing Modules and Motorized Cerna Components with a 2" Travel Range

Compact Controllers for Focusing Modules and Motorized Cerna Components with a 2" Travel Range

- Designed for Motorized Cerna Components with a 2" Travel Range
- Compatible with PMP-2XY(/M) Translating Platform and MMP-2XY Microscope Body Translator
- Knobs Provide Hand-Operated Control for Up to Three Channels
- Each Axis can be Individually Disabled to Prevent Unintended Movements and to Retain a Position
- Adjust Translation Speed via Top-Located Knob
- Remotely Control Translation Using Standalone Software (Requires 64-Bit Windows® 7 or 10)

Click for Details
Controller Front View
(Click for Back View)

Click to Enlarge
Three-Knob Joystick

The MCM3002 3-Axis Controller consists of a hand-operated knob box and a separate controller. Each side face of the knob box includes a rotating knob and a push-button switch that are dedicated to a single axis. The push-button switch enables and disables the axis, and is lit in green when the axis is enabled. Disabling the axis lets the user preserve a position or prevent accidental movements. A smaller knob on the top face adjusts the amount of translation per rotation of the knob (see the *Specs* tab for details).

The MCM3002 is compatible with motorized Cerna components that have a travel range of 2", such as our Microscope Body Translator and Translating Platforms. Since each controller has three channels, you only need to purchase enough channels for each of the modules you intend to drive. For example, a Cerna microscope equipped with a PMP-2XY Translating Platform (which has two axes) only requires one MCM3002 controller.

Axis translation can also be adjusted remotely via software (see the *Software* tab for details). Alternatively, LabVIEW™ software development kit (SDK) and support documentation are available to integrate these controllers with custom imaging software.

The MCM3002 includes adapter cables for connecting to motorized Cerna components with a 2" travel range.

Part Number	Description	Price	Availability
MCM3002	Three-Channel Controller and Three-Knob Joystick for 2" Cerna Travel Stages	$4,274.15	Today