MPC220 and MPC320
Motorized Fiber Polarization Controller

User Guide

Original Instructions

Contents

Chapter 1 Introduction

These motorized polarization controllers use stress-induced birefringence to alter the polarization in single mode fiber that is looped around two or three independent spools to create two or three independent fractional wave plates (fiber retarders). The amount of birefringence induced in the fiber is a function of the fiber cladding diameter, the spool diameter (fixed), the number of fiber loops per spool, and the wavelength of the light. (NOTE: The desired birefringence is induced by the loop in the fiber, not by the twisting of the fiber paddles). The fast axis of the fiber, which is in the plane of the spool, is adjusted with respect to the transmitted polarization vector by rotating the paddles to twist the fiber.

To transform an arbitrary input polarization state into a fixed and defined output polarization state, the controller uses a combination of two paddles (quarter-wave plate and quarter-wave plate) or three paddles (quarter-wave plate, half- wave plate, and quarter-wave plate). The retardance of each paddle may be estimated from the following equation:

$$\varphi(Radians) = \frac{2\pi^2 aNd^2}{\lambda D}$$

$$\varphi(Waves) = \frac{\pi aNd^2}{\lambda D}$$

Here, φ is the retardance, ***a*** is a constant (0.133 for silica fiber), *N* is the number of loops, *d* is the fiber cladding diameter, λ is the wavelength, and *D* is the loop diameter. While this equation is for bare fiber, the solution for Ø900 µm jacketed fiber will be similar enough that the results for this equation can still be used (i.e., the solution will not vary by a complete loop N for Ø900 µm jacketed fiber).

The MPC220 and MPC320 fiber polarization controllers have 2 and 3 paddles, respectively. These controllers are empty, which allows the user to install a fiber of their choice, and designed for use with Ø900 µm jacketed fiber.

Each controller offers 170° of movement, which is driven remotely using the Kinesis® software package via USB. Power is also provided through USB, and a suitable cable is supplied.

Fig. 1.1 MPC220 2-Paddle Fiber Polarization Controller

Chapter 2 Safety

2.1 Safety Information

For the continuing safety of the operators of this equipment, and the protection of the equipment itself, the operator should take note of the **Warnings, Cautions,** and **Notes** throughout this handbook and, where visible, on the product itself.

The following safety symbols may be used throughout the handbook and on the equipment itself.

Warning: Risk of Electrical Shock

Given when there is a risk of injury from electrical shock.

Warning

Given when there is a risk of injury to users.

Caution

Given when there is a risk of damage to the product.

Note

Clarification of an instruction or additional information.

2.2 General Warnings and Cautions

Warning

Do not move the paddles by hand. Doing so could damage the internal mechanism.

If this equipment is used in a manner not specified in the handbook, the protection provided by the equipment may be impaired. In particular, excessive moisture may impair operation.

Fluid spills, e.g., sample solution spills, should be avoided. If a spill does occur, clean it up immediately using absorbent tissue. Do not allow spilled fluid to enter the internal mechanism.

The equipment is for indoor use only.

Note

During operation, the actuator may emit an audible noise at a typical level of around 50 dB. This is normal, and may happen even if the motors are not moving.

Chapter 3 Overview

3.1 2- and 3-Paddle Fiber Polarization Controllers

A 3-paddle polarization controller can be used as a quarter-wave plate, half-wave plate, and quarter-wave plate in series to transform an arbitrary polarization state into any other polarization state. The first quarter-wave plate would transform the input polarization state into a linear polarization state. The half-wave plate would rotate the linear polarization state, and the last quarter-wave plate would transform the linear state into an arbitrary polarization state.

Similarly, the 2-paddle polarization controllers can be used as two quarter-wave plates to transform an arbitrary polarization state into any other polarization state. In this configuration, however, the control of the polarization will be coupled between the two paddles.

These controllers support Ø18 mm loops and allow the number of loops per paddle to be changed, thereby allowing complete control of the output polarization state over a broad range of wavelengths (300 to 2100 nm).

The retardation per paddle is a function of loop number and the cladding diameter of the fiber if the loop diameter is fixed. The retardation, in radians, is plotted for 1, 2, 3, and 4 loops per paddle for a fiber with cladding diameters of 80 µm and 125 µm (Fig. 3.1). Due to its small size, the MPC controllers cannot accommodate more than 4 loops per paddle.

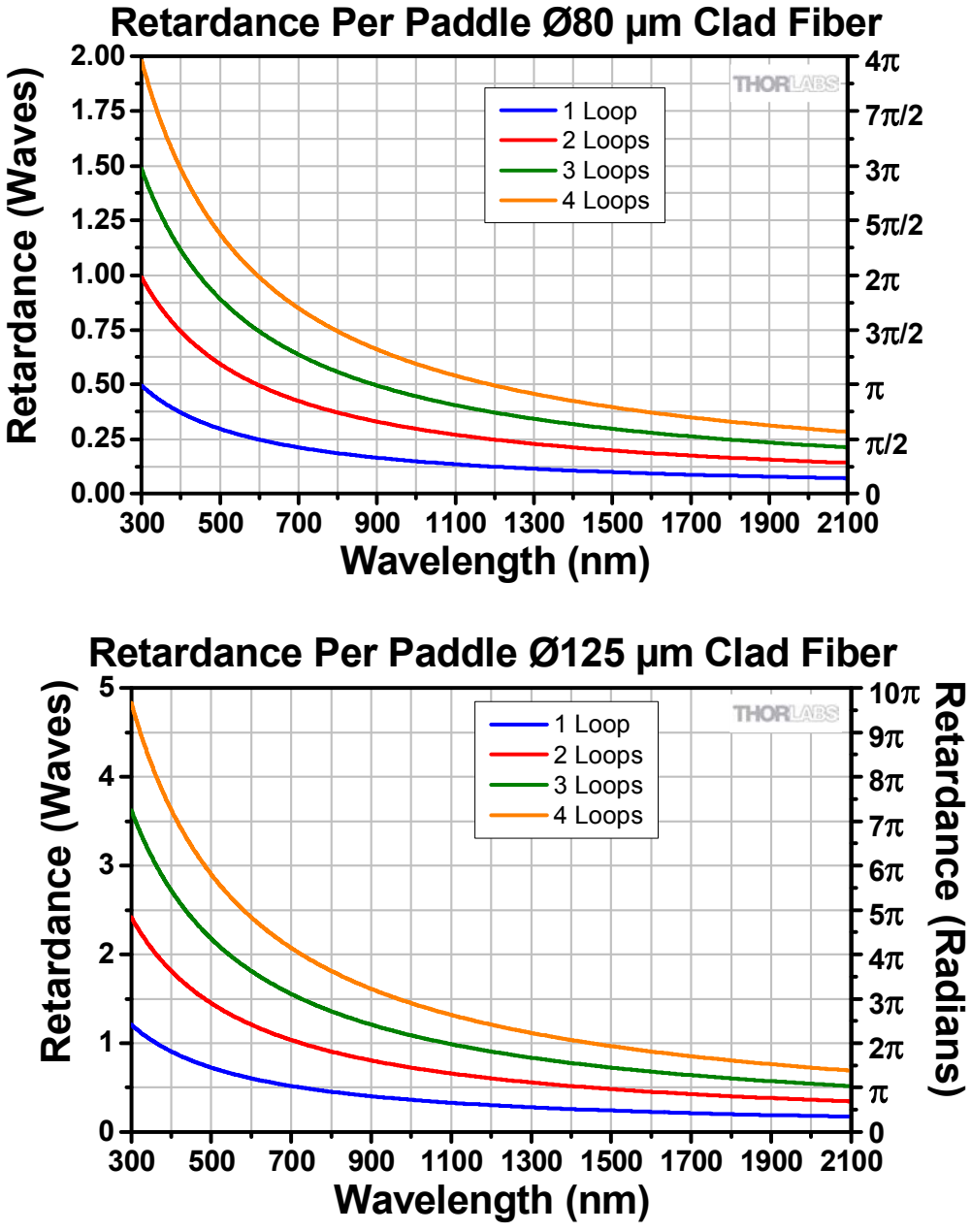


Fig. 3.1 Retardation for Ø80 µm and Ø125 µm Fiber Cladding

3.2 Recommended Number of Loops

The retardation of multi-order (including zero-order) quarter-wave plates is given by the following equation:

$$\frac{(2m+1)\pi}{2}$$

where *m* is an integer.

Similarly, the retardation of multi-order (including zero order) half-wave plates is given by:

$$(2m+1)\pi$$

See the table below for several solutions to the equations

Order	m	Quarter-Wave Plate Retardation	Half-Wave Plate Retardation
Zero	0	$\frac{\pi}{2} \approx 1.57$	$\pi \approx 3.14$
1st	1	$\frac{3\pi}{2} \approx 4.71$	$3\pi \approx 9.42$
2nd	2	$\frac{5\pi}{2} \approx 7.85$	$5\pi \approx 15.71$
3rd	3	$\frac{7\pi}{2} \approx 11.00$	$7\pi \approx 21.99$
4th	4	$\frac{9\pi}{2} \approx 14.14$	$9\pi \approx 28.27$
5th	5	$\frac{11\pi}{2} \approx 17.28$	$11\pi \approx 35.56$

The retardation of each paddle should be close to any number above. The paddle rotation sensitivity should also be taken into consideration when determining the number of fiber loops. Increasing the number of loops increases the sensitivity to rotation. One loop is usually too insensitive for most applications and is rarely used.

The number of recommended loops and recommended fiber for several wavelengths is given in the following tables.
These combinations come close to the desired quarter-wave retardation for a 18 mm outer diameter (OD) fiber loop.:

Wavelength	# of Loops for ~ 1/4 λ Retardation	Recommended Fiber
480 nm	3	460HP, SM450
630 nm	3	630HP or S630-HP
850 nm	3	780HP, SM800-5.6-125
980 nm	2	980HP, HI1060-J9, 980-HP
1064 nm	2	980HP, HI1060-J9, 980-HP
1310 nm	3	SMF28e+ and CCC1310-J9

These combinations come close to the desired half-wave retardation for a 18 mm OD fiber loop:

Wavelength	# of Loops for ~ 1/2 λ Retardation	Recommended Fiber
480 nm	2	460HP, SM450
630 nm	1	630HP or S630-HP
850 nm	1	780HP, SM800-5.6-125
980 nm	4	980HP, HI1060-J9, 980-HP
1064 nm	4	980HP, HI1060-J9, 980-HP
1310 nm	2	SMF28e+ and CCC1310-J9

3.3 Kinesis Software Overview

3.3.1 Introduction

The MPC series polarization controllers share all the benefits of the Thorlabs range of device controllers and drivers. This includes USB connectivity (allowing multiple units to be used together on a single PC), fully featured graphical user interface (GUI) panels, and extensive software function libraries for custom application development.

The Kinesis software suite provides a flexible and powerful PC based control system both for users of the equipment, and software programmers aiming to automate its operation.

The user interface allows full control of all settings and operating modes enabling complete 'out-of-box' operation without the need to develop any further custom software. It provides all of the necessary system software services such as generation of GUI panels, communications handling for multiple USB units, and logging of all system activity to assist in hardware troubleshooting. The Kinesis server is also used by software developers to allow for the creation of advanced automated positioning applications very rapidly and with great ease. The Kinesis server is described in more detail in Section 3.3.2.

3.3.2 Kinesis Server

Kinesis Controls are reusable compiled software components that supply both a graphical user interface and a programmable interface. With the Kinesis system, .Net controls are deployed to allow direct control over (and also reflect the status of) the range of electronic controller units, including the MPC series polarization controllers. Software applications that use .Net controls are often referred to as 'client applications'. A .Net control is a language independent software component. Consequently the controls can be incorporated into a wide range of software development environments for use by client application developers. Development environments supported include Visual Basic, LabVIEW®, Visual C++, C++ Builder, HPVEE, VB.NET, C# .NET, and, via VBA, Microsoft® Office applications such as Excel and Word.

Consider the control supplied for the MPC320 controller:

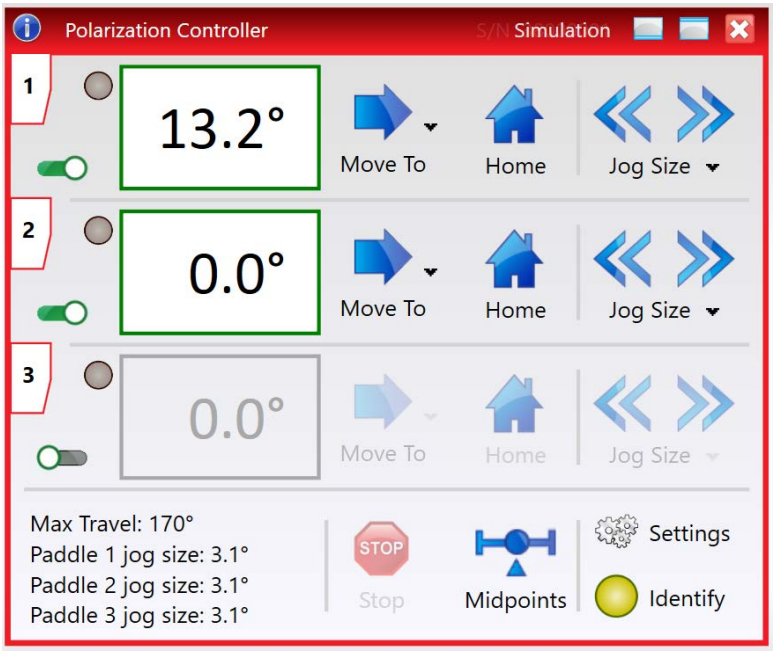


Fig. 3.2 Typical MPC320 GUI Panel

This control provides a complete user graphical instrument panel to allow the polarizer to be manually operated, as well as a complete set of software functions to allow all parameters to be set and operations to be automated by a client application. The instrument panel reflects the current operating state of the unit to which it is associated (e.g. paddle position). Updates to the panel take place automatically when a user (client) application is making software calls into the same control.

The Kinesis Controls collection provides a rich set of graphical user panels and programmable interfaces allowing users and client application developers to interact seamlessly with the Kinesis hardware. Each of the Kinesis controllers has an associated .Net control and these are described fully in the handbooks associated with the controllers.

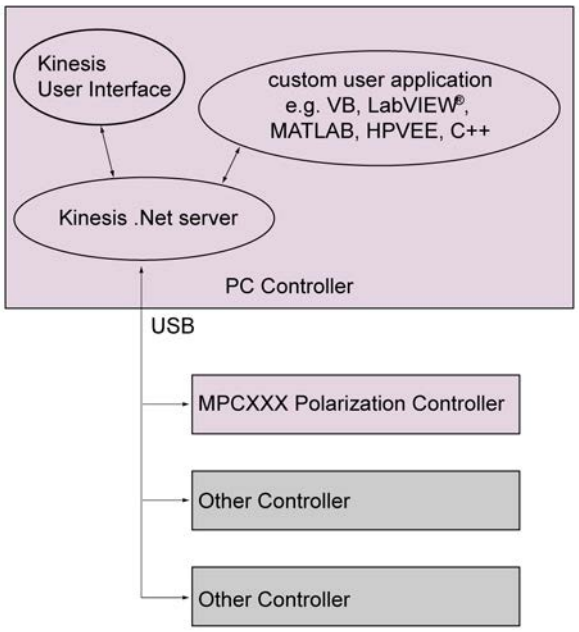


Fig. 3.3 System Architecture Diagram

Refer to the main Kinesis Software online help file, for a complete programmers guide and reference material on using the Kinesis Controls collection. This is available either by pressing the F1 key when running the Kinesis server, or via the Start menu, Start\Programs\Thorlabs\Kinesis\Kinesis Help.

3.3.3 Software Upgrades

Thorlabs operates a policy of continuous product development and may issue software upgrades as necessary.

Chapter 4 Mechanical Installation

4.1 Environmental Conditions

Warning
Operation outside the following environmental limits may adversely affect operator safety.

Location: Indoor use only

Maximum altitude: 2000 m

Temperature range: 15°C to 40°C

Maximum Humidity: Less than 80% RH (non-condensing) at 31°C

To ensure reliable operation the unit should not be exposed to corrosive agents or excessive moisture, heat or dust.

If the unit has been stored at a low temperature or in an environment of high humidity, it must be allowed to reach ambient conditions before being powered up.

The unit is not designed to be used in explosive environments.

4.2 Mounting

Warning
The safety of any system incorporating this equipment is the responsibility of the person performing the installation.

The controller can be used in any orientation and at any angle. The base plate features a number of M6 (1/4”-20) clearance slots (3 for MPC220 and 4 for MPC320) to allow mounting to a standard 1" or 25 mm pitch optical table or breadboard as shown below.

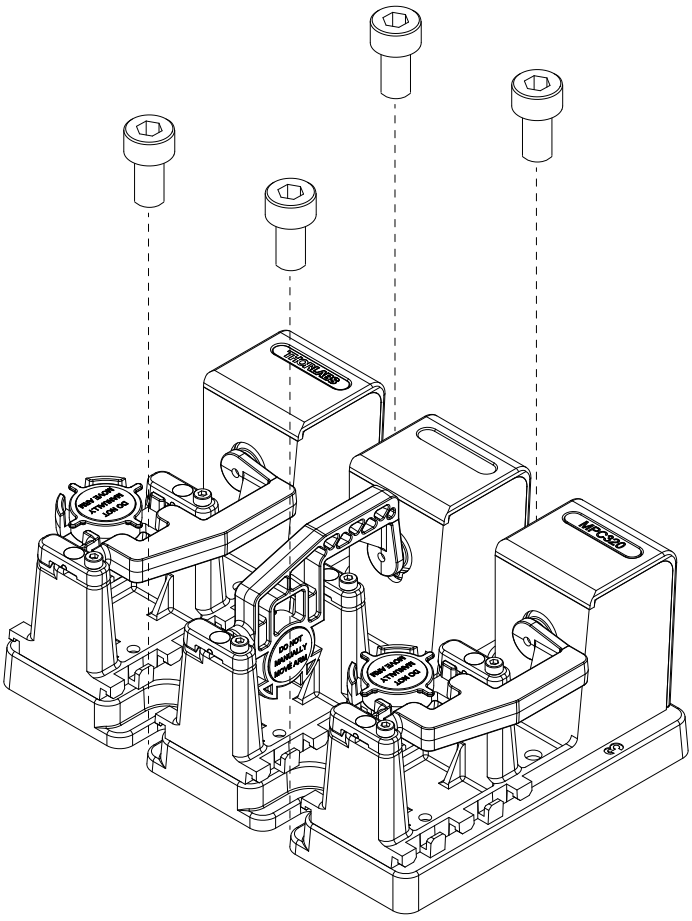


Fig. 4.1 Fixing to the Work Surface

1) Attach the controller to the work surface using appropriate standard fixings (not supplied) through the two slots in each side of the base plate.

4.3 Paddle Identification

The individual paddles can be identified by numbers on the base as shown in Fig. 4.2.

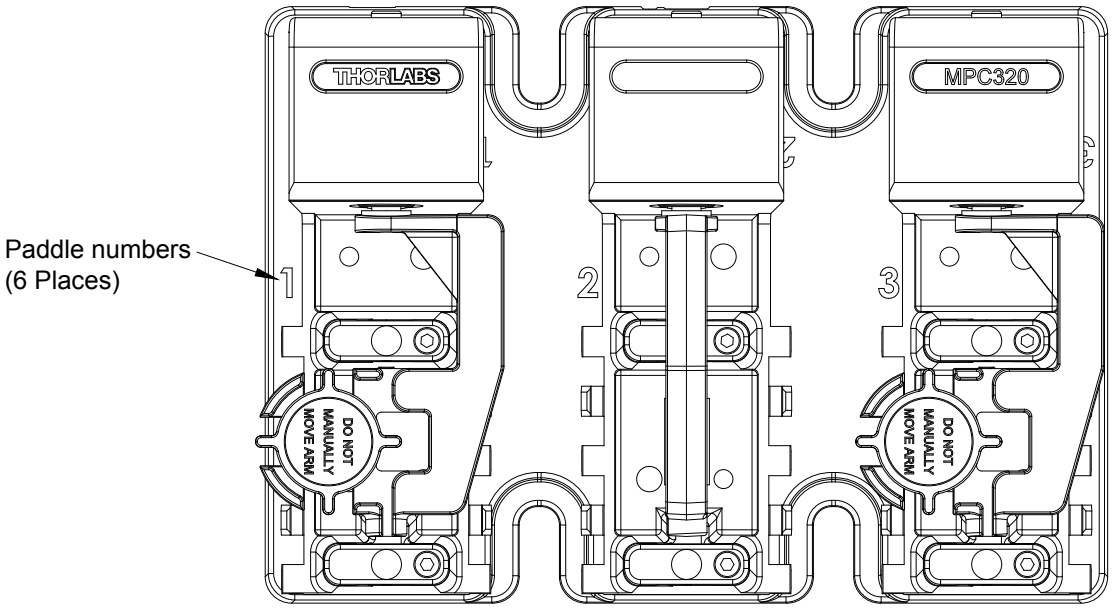


Fig. 4.2 Paddle Identification Numbers

Chapter 5 Software & Electrical Installation

5.1 Installing the Software

Caution

If your PC becomes unresponsive (e.g. due to an operating system problem, entering a sleep state condition, or screen saver operation) for a prolonged period, this may interrupt communication between the software and the hardware, and a communications error may be generated. To minimize the possibility of this happening it is strongly recommended that any such modes that result in prolonged unresponsiveness be disabled before the software is run. Please consult your system administrator or contact Thorlabs technical support for more details.

Caution

Some PCs may have been configured to restrict the users ability to load software, and on these systems the software may not install/run. If you are in any doubt about your rights to install/run software, please consult your system administrator before attempting to install.

If you experience any problems when installing software, contact Thorlabs and ask for Technical Support.

DO NOT CONNECT THE STAGE TO YOUR PC YET

1) Download the software from www.thorlabs.com.
2) Locate the downloaded setup.exe file and move to a suitable file location.
3) Double-click the setup.exe file and follow the on-screen instructions.

5.2 Connecting The Hardware

1) Perform the mechanical installation as detailed in Chapter 4.
2) Install the Kinesis software - see Section 5.1.
3) Using the USB cable supplied, connect the polarizer unit to your PC.

Notes

If direct connection to a PC is not convenient, a powered USB hub can be used.

The USB cable should be no more than 3 meters in length. Communication lengths in excess of 3 meters can be achieved by using a powered USB hub.

On initial power up, the paddles will move to the mid (85°) position automatically. This is the default 'Home' position, but it can be adjusted in the Settings panel to be anywhere between 0 and 170° - see Section 8.3.

4) Windows® should detect the new hardware. Wait while Windows installs the drivers for the new hardware.

5.3 Verifying Software Operation

5.3.1 Initial Setup

1) Run the software and check that the GUI panel appears and is active.

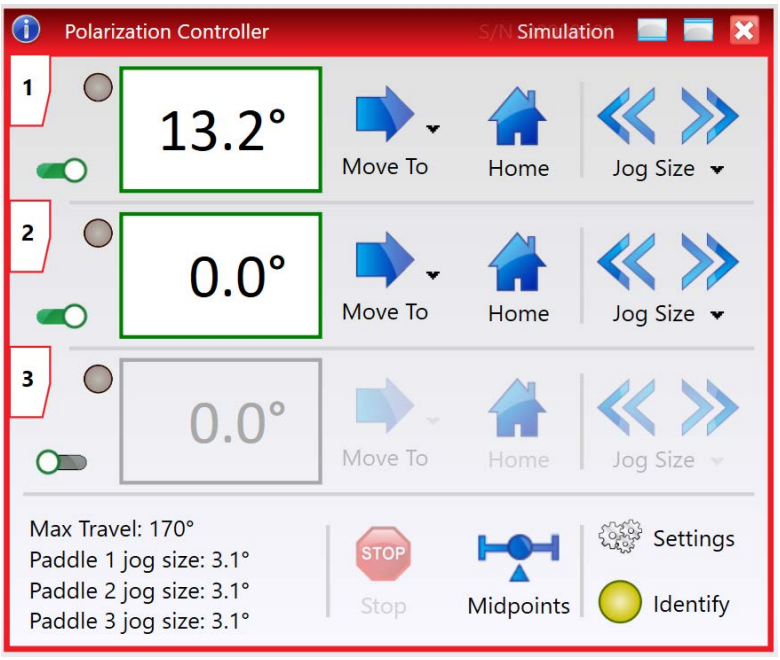


Fig. 5.1 Polarizer GUI Panel

2) Click the Home button to send each channel to the 85° (middle) position. This is the default 'Home' position, but it can be adjusted in the Settings panel to be anywhere between 0 and 170° - see Section 8.3.
3) Follow the tutorial steps described in Chapter 7 for further verification of operation.

Chapter 6 Setup

6.1 Loading the Fiber

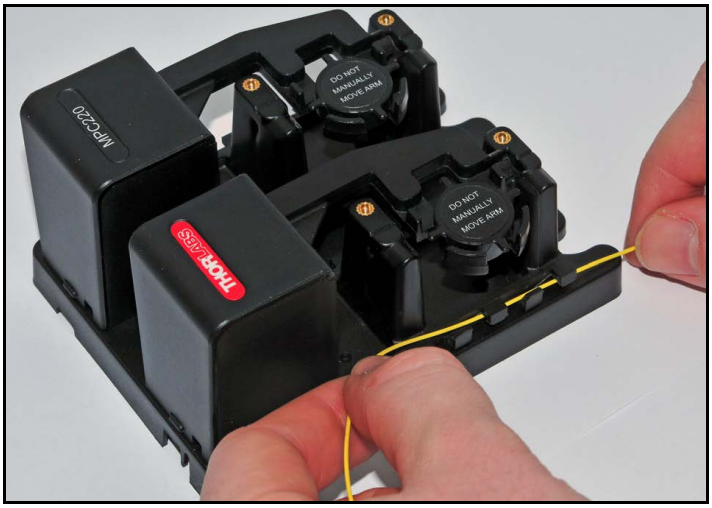
1) Using the Kinesis software, move the paddles to the 0° position.

Caution

Do not move the paddles by hand. This could damage the unit and invalidate the warranty.

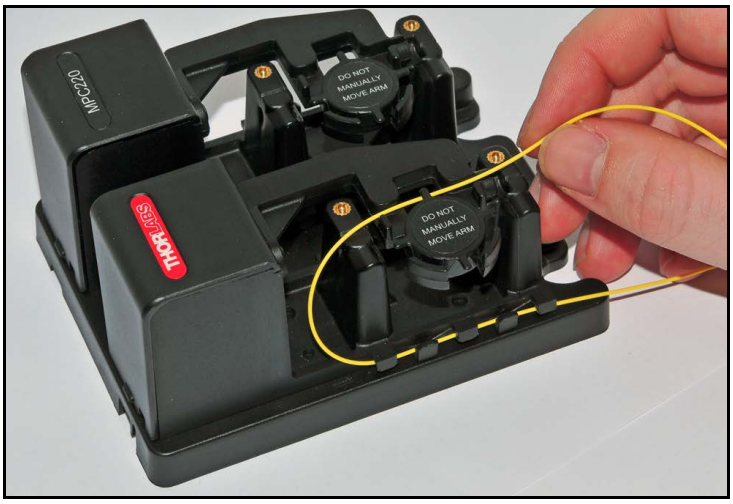
Fiber clamps removed

2) Orientate the unit as shown above with the paddles on the right, then remove the fiber clamps from all the paddles.



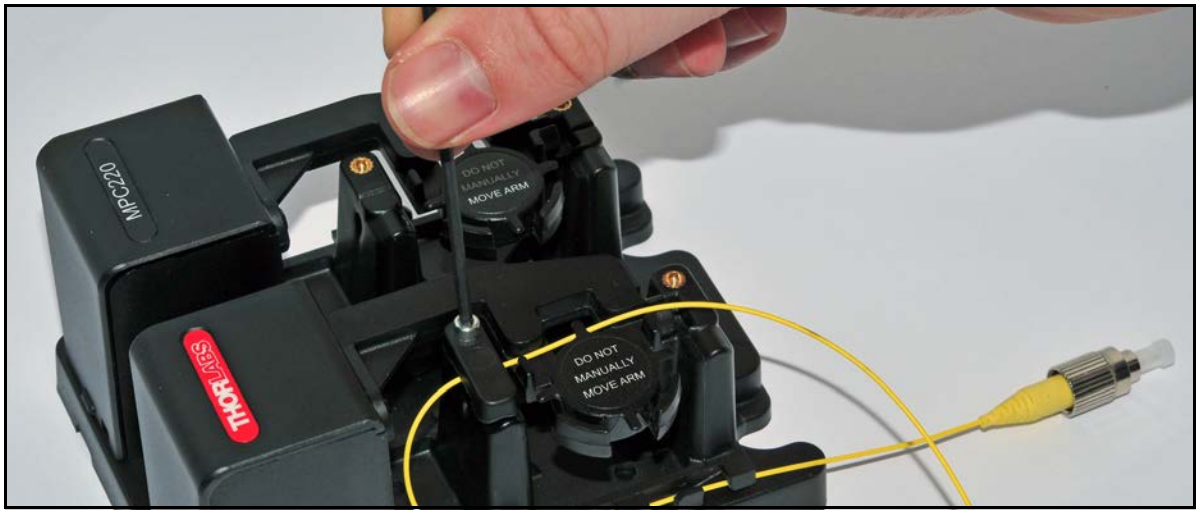
Fiber correctly routed through the lower guides

3) Working from the right to left, feed the fiber into the entry (lower) guides in the base of the unit next to paddle 1. The paddle number is marked on the base - see Section 4.3.



Fiber correctly routed through the upper guide

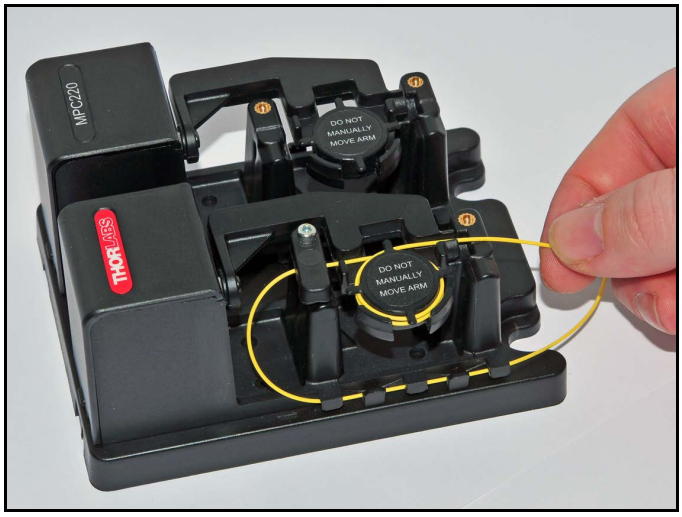
4) Loop the fiber round and, working from the left to right, feed the fiber into the upper guide in paddle 1. Do not pull or loop the fiber too tightly. Leave a small amount of slack a shown above.



5) Fit the first fiber clamp to the paddle 1 and tighten until just finger tight. Do not overtighten.

Locating the fiber in the guides on the paddle

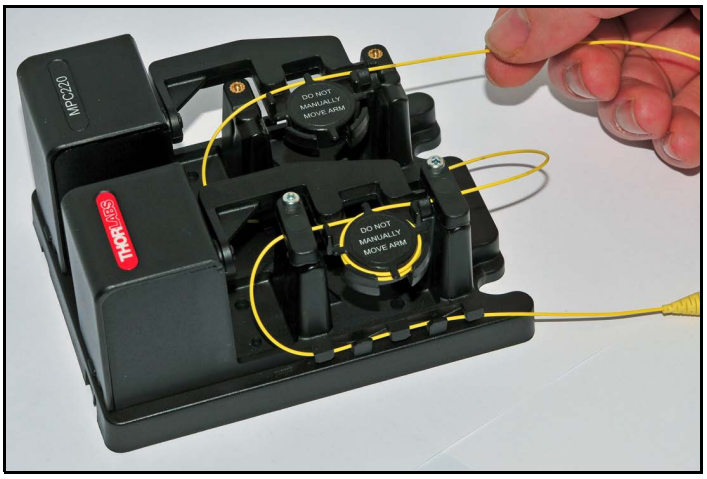
6) Make a loop in the fiber and feed into the guides at the top and bottom of the paddle, ensuring that the fiber sits correctly into the grooves as shown above.



Fiber correctly routed through the guides in the paddle

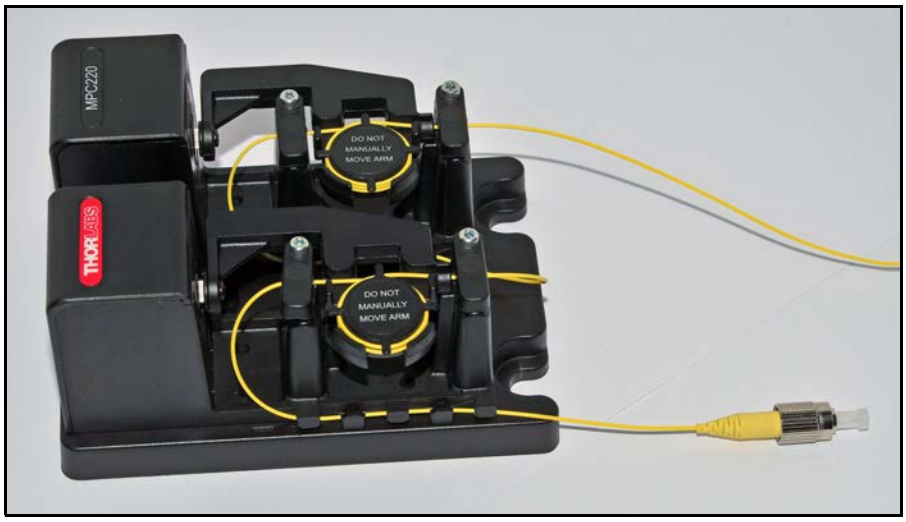
7) Make more loops as required for the associated fiber type and wavelength - see Section 3.2. The minimum is one loop, the maximum is 4 loops.

8) Fit the second fiber clamp to the paddle 1.



Fiber correctly routed through the upper guides on paddle 2

9) Loop the fiber from right to left and feed into the guides on paddle 2 as detailed in steps 3) to 4). Ensure that the fiber sits correctly into the guides as shown above.



10) Repeat steps 5) to 8) for the remaining paddles

11) Working from left to right, feed the fiber into the exit guides in the base of the unit.

Chapter 7 Operation - Tutorial

7.1 Introduction

The following brief tutorial guides the user through a typical series of actions and parameter adjustments performed using the PC based software. It assumes that the unit is connected to the host PC and that the software is already installed - see Section 5.1.

Warning

Do not move the paddles by hand. Doing so could damage the internal mechanism.

7.2 Using the Kinesis Software

The Kinesis application allows the user to interact with any number of hardware control units connected to the PC USB Bus (or simulated via the Kinesis Simulator utility). This program allows multiple graphical instrument panels to be displayed so that multiple units can be controlled. All basic operating parameters can be set through this program, and all basic operations (such as paddle jogging adjustment) can be initiated.

This tutorial shows how the application provides all of the functionality necessary to operate the hardware.

1) Install the polarizer as detailed in Section 4.2. and load the fiber as shown in Section 6.1.
2) Connect the polarizer to the control PC using the USB cable provided.
3) Run the Kinesis program - Start/All Programs/Thorlabs/Kinesis/Kinesis. The server registers automatically the units connected on the USB bus and displays the associated GUI panels as shown in Fig. 7.1.

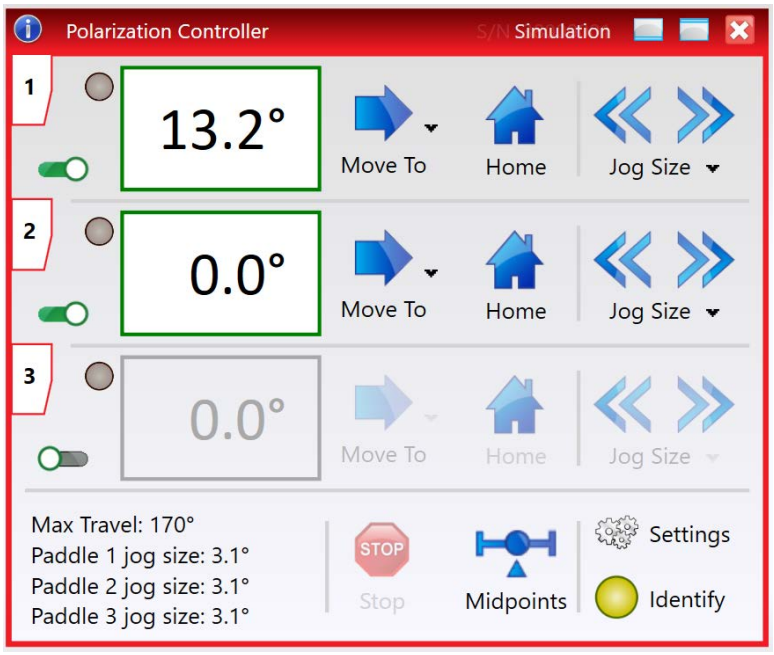


Fig. 7.1 GUI Panel Showing Step and Identify Buttons

4) In the GUI, click the enable switch  next to each paddle to enable each paddle.

The paddles are lit green when enabled and grayed out when disabled as shown above.
The paddles associated with each channel can be identified by numbers etched into the base, as shown in Fig. 4.2.

7.3 Homing Motors

Homing the motor moves the paddle to the zero limit switch.

Note

It is not necessary to 'home' the paddles before use as with other motorized actuators. The unit will recognize the paddle positions on power up.

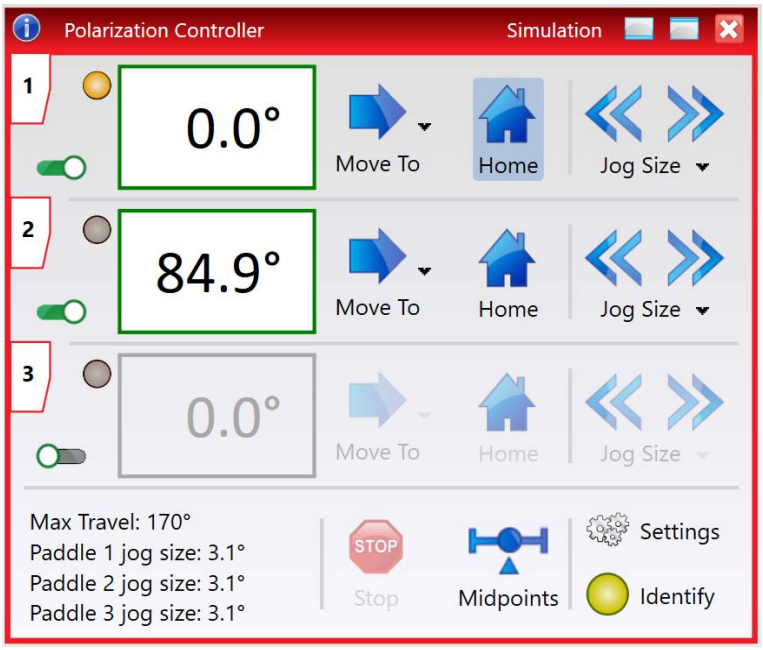


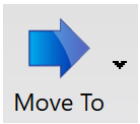
Fig. 7.2 Polarizer GUI Home Button

5) Click the Home button for each paddle. The LED next to the display is lit amber to show the paddle is in motion. The displayed position counts to 85.0°. This is the default 'Home' position, but it can be adjusted in the Settings panel to be anywhere between 0 and 170° - see Section 8.3.

7.4 Moving to an Absolute Position

Absolute moves are measured in real world units (e.g. degrees), relative to the zero position.

Moves are performed using the move velocity set in the settings panel (see Section 8.3.). The velocity settings relate to the maximum velocities at which a move is performed.

1) On the GUI panel, click the 

button to display the Move Settings panel 

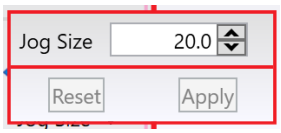
.

2) Make parameter changes as required. The move position can be set in the range 0° to 170°.
3) Click the Move arrow  in the pop-up window to move the associated paddle to the position previously set.

7.5 Jogging

During operation, the paddles are jogged using the GUI panel arrow keys. When the Jog button is clicked, the motor moves by the step size specified in the Jog Size parameter. If the jog key is held down, jogging is repeated until the button is released.

1) On the GUI panel, click the 

button to display the Jog Settings panel 

.
2) Make parameter changes as required. Jog step size can be set in the range 0.12° to 90°.
3) Click 'Apply' to save the settings and close the window, click 'Reset' to return to the previously saved values.
4) On the GUI panel, click the jog arrows  to move the associated paddle forwards and backwards by the amount set at step (2).
If the arrow is pressed and held, jogging continues until the button is released.

7.6 Setting Move Sequences

The Kinesis software allows move sequences to be programmed, allowing several positions to be visited without user intervention. For more details and instructions on setting move sequences, please see the *Kinesis Helpfile*.

7.7 Changing and Saving Parameter Settings

During operation, certain settings (e.g. max velocity, jog step size, etc.) can be changed as required. Other settings (e.g. PID parameter values) cannot be changed so easily. When the Kinesis Server is run up and the stage/actuator association made, suitable default settings are loaded and these values have been chosen to provide safe performance in the majority of applications. However, for applications where these settings need to be changed, a new set of Device Startup settings must be created, which can then be applied and/or uploaded on subsequent start up. See the *Kinesis Helpfile* for more details.

Chapter 8 Software Reference

8.1 Introduction

This chapter gives an explanation of the parameters and settings accessed from the Kinesis software running on a PC.

8.2 GUI Panel

The following screenshot shows the graphical user interface (GUI) displayed when accessing the polarization controller using the Kinesis software.

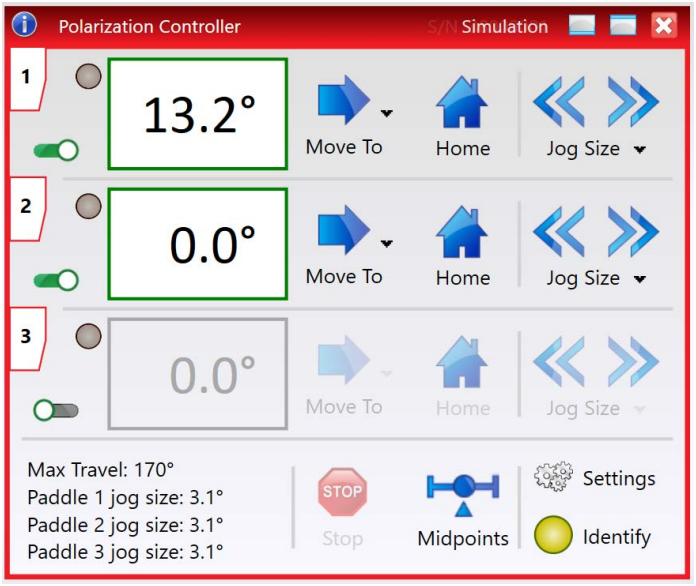


Fig. 8.1 Polarizer Software GUI

Note

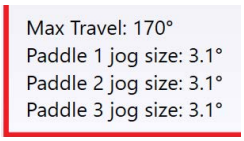
The serial number of the Polarizer Controller associated with the GUI panel is displayed in the top right hand corner. This information should always be provided when requesting customer support.

Position Window - Shows the position (in degrees) of the associated paddle.

The channel is enabled when the switch to the lower right of the display is lit green and moved to the right as shown. The paddle is moving when the LED is lit amber.

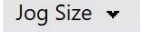
Move - Opens the Move Settings window, so that position data can be entered - see Section 7.4.

Moves are performed using the current velocity parameters which can be changed in the Settings panel - see Section 8.3. The present settings are displayed below the window.



Parameters Overview - The present setting for the jog step size of each paddle. The travel range of the associated controller is also displayed.

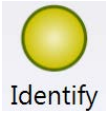
These settings can be adjusted by clicking the Settings button to display the settings window, see Section 8.3.

Jog Controls - Used to increment or decrement the motor position. When the arrows are clicked, the motor is driven in the selected direction at the jog velocity, one step per click. The step size can be changed by clicking the 

button to display the settings panel - see also Section 7.5.

Midpoints - Moves all enabled paddles to the mid position, i.e. 85°. This is useful if the home position has previously been adjusted to be somewhere other than the default 85° position - see also Section 8.3.

Identify - When this button is pressed, the ACTIVE LED on the front panel of the associated hardware unit will flash for a short period.



Settings - Displays the Settings panel, which allows the operating parameters to be entered for the motor drive - see Section 8.3.

Home - Sends the motor to its home position (default 85°).

Stop - Halts the movement of the motor.

8.3 Settings Panel

The Settings panels allows various parameters to be adjusted.

1) On the GUI panel, click the Settings button to display the Settings panel.

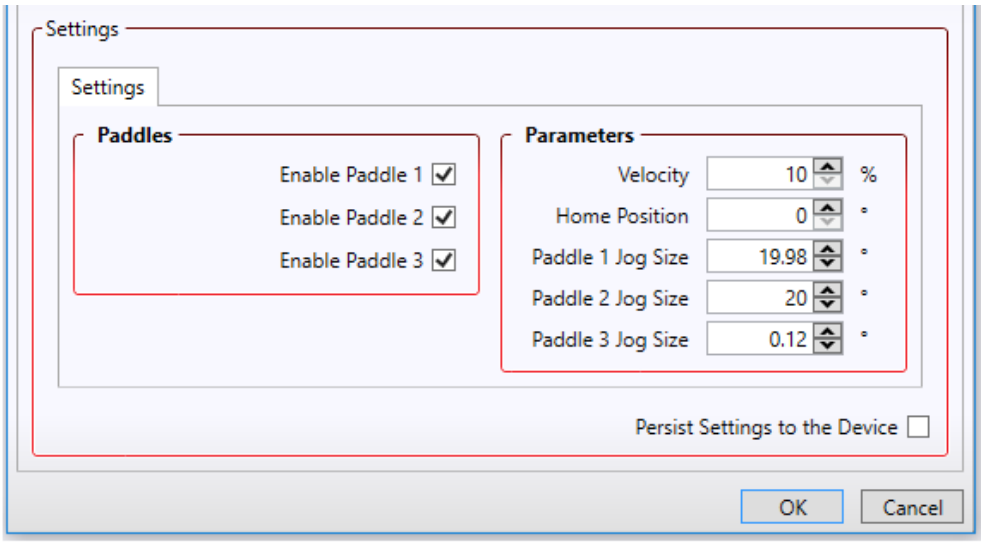


Fig. 8.2 Polarizer Settings Panel

Paddles - Each paddle can be enabled/disabled by checking or unchecking the associated box.

Velocity - The velocity of motion when a move command is received. This set in the range 10% to 100% of the max 400°/s.

Home Position - The home position is usually set to 0° but can be set between 0 and 170° depending on the application requirements.

Note

The GUI panel always displays the paddle position as measured from 0°, irrespective of the setting of the home position.

Paddle Jog Size - The size of step to be performed each time the jog arrows on the GUI panel are clicked.

Click the 'Persist Settings to Hardware' checkbox to save the settings to the unit. These settings will then be loaded on power up.

Click OK to close the window.

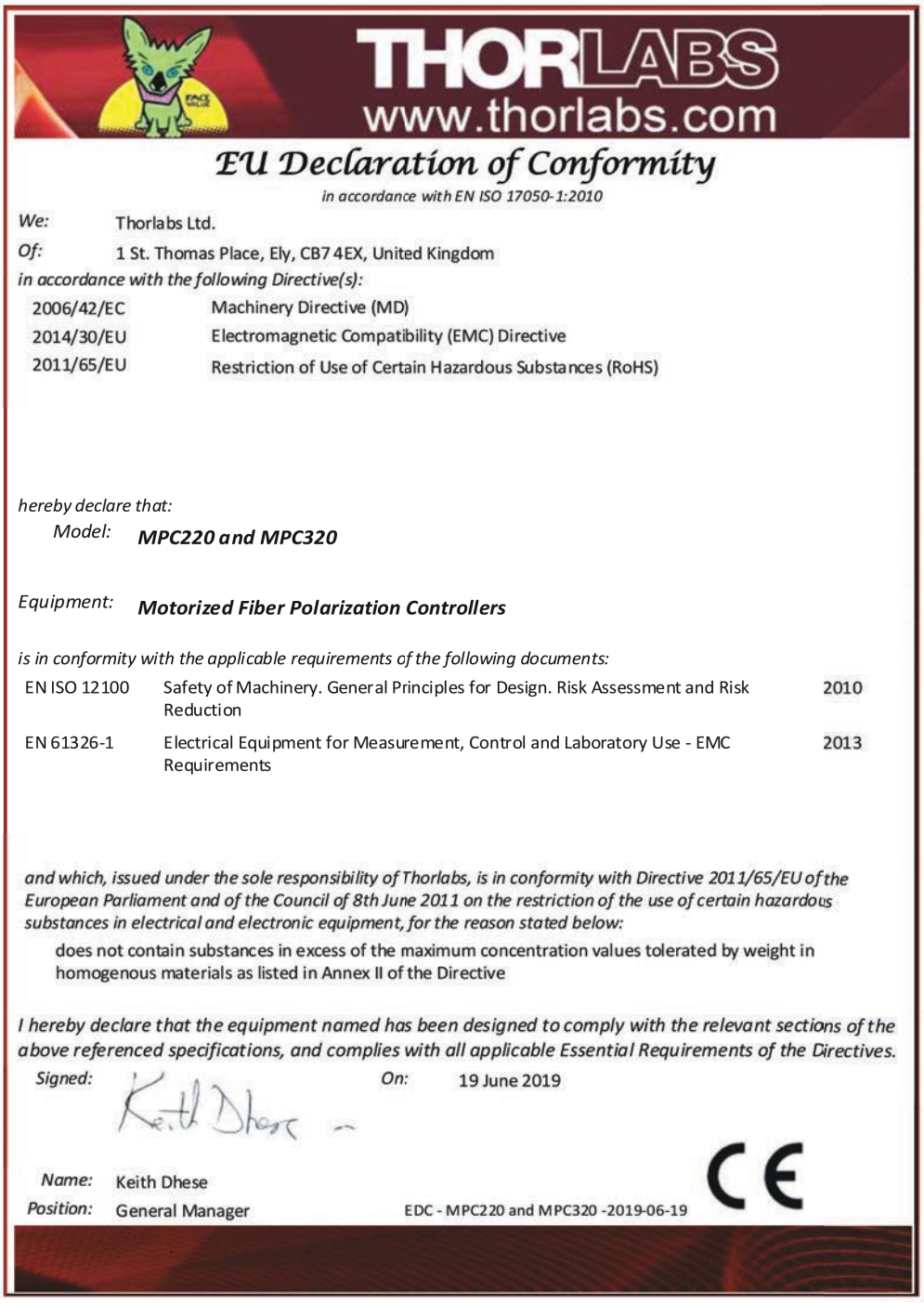
Chapter 9 Specifications

Parameter	MPC220	MPC320
Construction Material (Controller Body)	Black Acrylonitrile Butadiene Styrene (ABS)	
Number of paddles	2	3
Loop Diameter (Ø900 µm Jacketed Fiber)	18 mm	
Paddle Rotation	0 to 170°	
Compatible Fiber	Ø900 µm Jacket Single Mode Fibers and Patch Cables	
Minimum Fiber Length	75 cm for 1 Loop per Paddle 110 cm for 4 Loops per Paddle	95 cm for 1 Loop per Paddle 155 cm for 4 Loops per Paddle
Minimum Step Size	0.12°	
Maximum Rotation Speed	400°/sec	
Max Number of Loops per Paddle	4	
Bidirectional Repeatability	2°	
Operating Temperature Range	-20 °C to +60 °C	
Motor Type	DC Motor	
Motor Drive Voltage	5 V	
CPU Connection	Micro USB Type B	
Unit Dimensions L x W x H	85.2 x 115.7 x 61.0 mm (3.35" x 4.55" x 2.40")	143.2 x 101.4 x 61.0 mm (5.64" x 3.99" x 2.40")
Footprint (for full paddle rotation) L x W x H	90.1 x 115.7 x 62.0 mm (3.55" x 3.99" x 2.44")	145.3 x 101.4 x 62.0 mm (5.72" x 3.99" x 2.44")

Chapter 10 Regulatory

10.1 Declarations Of Conformity

10.1.1 For Customers in Europe



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Ltd.

Of: 1 St. Thomas Place, Ely, CB7 4EX, United Kingdom

in accordance with the following Directive(s):

2006/42/EC	Machinery Directive (MD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: **MPC220 and MPC320**

Equipment: **Motorized Fiber Polarization Controllers**

is in conformity with the applicable requirements of the following documents:

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

and which, issued under the sole responsibility of Thorlabs, is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

does not contain substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed: Keith Dhese On: 19 June 2019

Name: Keith Dhese

Position: General Manager

CE

EDC - MPC220 and MPC320 -2019-06-19

10.1.2 For Customers In The USA

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the company could void the user's authority to operate the equipment.

Chapter 11 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Japan
Thorlabs Japan, Inc.
sales@thorlabs.jp

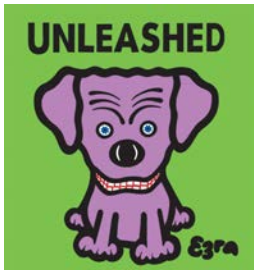
UK and Ireland
Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Scandinavia
Thorlabs Sweden AB
scandinavia@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

China
Thorlabs China
chinasales@thorlabs.com

Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.



THORLABS

www.thorlabs.com