THORLABS

MJC1, MJC2, and MJC3
1-, 2-, and 3- Axis Joysticks

User Guide



Original Instructions

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Chapter 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.



Warning: Risk of Electrical Shock
Given when there is a risk of electrical shock.



Warning

Given when there is a risk of injury to users.



Caution

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

Note

Clarification of an instruction or additional information.

1.1 General Warnings

Warning



If this equipment is used in a manner not specified by the manufacturer, the equipment might malfunction. Excessive moisture may impair operation. Spillage of fluid, such as sample solutions, should be avoided. If spillage does occur, clean up immediately using absorbent tissue. Do not allow spilled fluid to enter the internal mechanism.

Chapter 2 Introduction

The MJCx series joysticks have been designed for microscope users, to provide intuitive, tactile, manual positioning of the microscopic stage. These joysticks can also be used with any stage driven by a compatible Thorlabs controller. Each console features a one, two or three axis joystick for Z, XY or XYZ control and is used in conjunction with the motor or piezo controller driving the device. Furthermore, if the parameter settings are saved (persisted) to the controller, the controller need not be connected to a host PC, thereby allowing remote operation. Each joystick features a push button which allows user to swap between fast and high precision modes. They are also USB HID Class Devices, and as such can be configured and used with a variety of different devices that can utilize the USB HID Class.

Chapter 3 Installation

3.1 Environmental Conditions



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

The unit is designed for indoor use only.

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

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

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.

3.2 Connection and Set Up with Controllers

Perform the following installation steps in the GUI Panel:

1. Connect the stage to the controller as described in the handbook of the stage and controller unit.
2. Using either the USB or the DIN 6 lead supplied, connect the joystick console to the HANDSET IN connector on the controller unit.
3. Switch ON the controller.
4. Wait until the red warning LED on the joystick console, and the Channel Enable LEDs on the controller front panel stop flashing (~3s). This indicates that phase initialization is complete.
5. Press and hold the 'Mode/Hold to Home' button for 2 seconds, then release to home the stage. When homing is complete, the green LED stops flashing.
6. The stage can now be moved using the joystick, GUI panel, or by setting commands to move each axis by relative or absolute amounts – refer the helpfile supplied with the software server for more information.

3.2.1 Controller Capability

The MJC1 is compatible with the following controllers:

- BPC30x Series Benchtop Piezo Controllers

The MJC2 and the MJC3 are compatible with the following controllers:

- BBD Series Benchtop Brushless DC Motor Controllers
- RBD201 Rack-Mounted Brushless DC Motor Controllers
- BSC20x Series Benchtop Stepper Motor Controllers

3.2.2 Operation

The joystick has 2 modes of operation, LOW gear and HIGH gear. To switch between these modes, press the MODE/HOLD TO HOME button. When the green LED is lit, HIGH mode is selected.

The speed of the move increases with deflection of the joystick from the center position. Fine tuning of the speed control is achieved by adjusting the Speed Knob. The speed knob acts as a scalar multiplier of the joystick output, which can be continuously scanned through. When the speed knob is set to zero (fully counterclockwise) movements of the joystick will not result in the stage moving.

The velocity and acceleration of moves performed in these modes is set in the Advanced - Misc. Tab in the GUI Settings panel; see the handbook supplied with the controller for more information. These are the GUI settings of the controller software.

3.2.3 LED Summary

The list of LEDs is as follows:

- Red LED Flashing - Phase initialization is in progress. The joystick will not respond to any action.
- Green LED Flashing - The stage has not been homed. Press and hold the MODE/HOLD TO HOME button to initiate homing.
- Normal Operation - Red LED not lit, green LED reflects the mode of operation, i.e., high gear if lit.
- Red LED On - a fault condition has occurred that may require intervention. For example: movement may be blocked, or the stage may have hit a limit switch. Under normal conditions, the red LED should not be lit. If the software is running when the fault occurs, the GUI provides more information about the nature of the fault. Normally, a fault condition will also cause the channel to be disabled. If a fault occurs, it should be investigated and rectified (e.g., if the fault was caused by a blocked movement, then the obstruction must be removed). A fault can be cleared by re-enabling the associated channel. If the fault condition persists, then the red LED will be lit again.

3.3 Connection and Setup over USB HID

The MJCx series joysticks are USB HID Class Devices, and as such can be configured and used with a variety of different devices that can utilize the USB HID Class. More resources regarding the Device Class Definition for USB HID can be found at usb.org/hid. The hardware controls and the IN Report Structure used specifically for the MJCx series joysticks are explained in more detail below.

3.3.1 Hardware Controls Overview

The table below describes the hardware controls across all the MJCx Joysticks.

Hardware Control	Description	HID Report Summary
Push-Button	Push button switch marked as “Mode/Hold to Home”	1 byte IN report (Boolean)
Speed Knob	Potentiometer which can be used as an extra axis. In Thorlabs controllers the value for this is used as a scalar for the joystick outputs	1 byte IN report (Integer)
MJC1 Position Knob	Encoder Knob, output is defined as encoderVal and is dependent on the velocity of its motion	1 byte IN report (Signed Integer)
MJC2 Joystick	Joystick Knob that can be moved up/down, left/right or a combination of both	1 byte IN report (Signed Integer) for up/down movement, 1 byte IN report (Signed Integer) for left/right movement
MJC3 Joystick	Joystick Knob that can be moved up/down, left/right, twisted clockwise/counterclockwise or a combination of all the above	1 byte IN report (Signed Integer) for up/down movement, 1 byte IN report (Signed Integer) for left/right movement, 1 byte IN report (Signed Integer) for twists.

3.3.2 VID and PID

For those interested in configuring the MJCx Series Joysticks for their own applications, the VID and PID used to identify the joysticks are listed in the table below. These can also be found by finding the device in the Device Manager (under HID devices), and then right-clicking and going to Properties → Events → Information.

Item #	VID	PID
MJC1	0x1313	0x9000
MJC2	0x1313	0x9000
MJC3	0x1313	0x9000

3.3.3 USB HID IN Report

The table below details the IN report by byte, where xVal/encoderVal refers to the x-axis on the MJC2 and the MJC3 or the rotary encoder knob on the MJC1, the yVal refers to the y-axis on the MJC2 and MJC3, the zVal refers to the z-axis on the MJC3, the Speed Knob is the speed adjustment knob and the button is used to switch between gears.

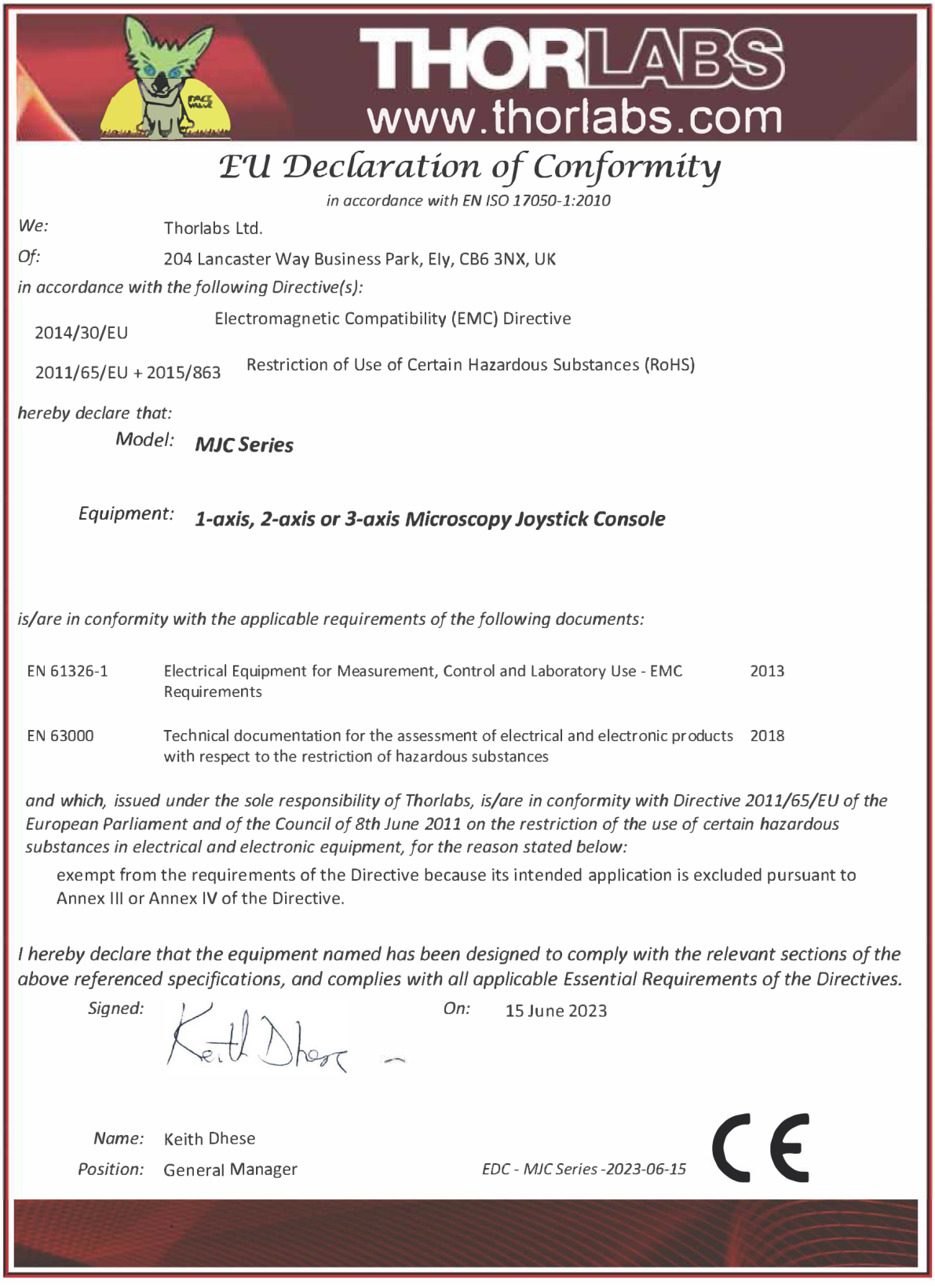
Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Speed Knob	Button	zVal	yVal	xVal or encoderVal
0 to 255	0/1	-127 to 127	-127 to 127	-127 to 127

- The xVal/encoderVal, yVal and zVal will produce a value equal to 0 in the IN report when there is no input detected.
    - The encoderVal will produce a negative value in the IN report for a counterclockwise rotation, and a positive value for a clockwise rotation.
    - The xVal will produce a negative value in the IN report for a movement left, and a positive value for a movement right.
    - The yVal will produce a negative value in the IN report for a movement up, and a positive value for a movement down.
    - The zVal will produce a negative value in the IN report for a movement counterclockwise, and a positive value for a movement clockwise.
- The value produced in the encoderVal IN report is dependent on the velocity at which the knob is being rotated, while the value produced in the xVal, yVal and zVal is dependent on the position of the knob.
- The button will produce a value of either 0 or 1 in the IN report dependent on whether the button is pressed or released.
- The Speed Knob will produce a value of 0 when fully turned counterclockwise and 255 when fully turned clockwise.

Chapter 4 Specifications

Item #	MJC1, MJC2, and MJC3
Input Power Requirements	
Voltage	5 VDC (USB)
Current	<100 mA
Specifications	
USB	USB 1.1 using a USB type C connector
Resolution of Joysticks/Encoders	8 bits
General Specifications	
Thorlabs Controller Connection	Mini-DIN or USB C
Computer Connection	USB Type-A connector
Housing Dimensions (Excluding Joystick Knob Height)	134.9mm x 230.5mm x 52.6mm (5.31” x 9.07” x 2.07”)

Chapter 5 Certifications and Compliance



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Ltd.

Of: 204 Lancaster Way Business Park, Ely, CB6 3NX, UK

in accordance with the following Directive(s):

2014/30/EU Electromagnetic Compatibility (EMC) Directive

2011/65/EU + 2015/863 Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***MJC Series***

Equipment: ***1-axis, 2-axis or 3-axis Microscopy Joystick Console***

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

EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	2018

and which, issued under the sole responsibility of Thorlabs, is/are 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:

exempt from the requirements of the Directive because its intended application is excluded pursuant to Annex III or Annex IV 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:* 15 June 2023

Name: Keith Dhese

Position: General Manager

EDC - MJC Series -2023-06-15

CE

Chapter 6 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.



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