THORLABS

# M30X(/M) and M30XY(/M)

# DC Servo Motor Driven Translation Stages with Integrated Controller

# Kinesis User Guide




Original Instructions

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# Chapter 1 Introduction and Overview

## 1.1. Introduction

M30X(/M) and M30XY(/M) are compact 1- and 2- axes linear stages that use internally integrated brushed DC servo motors with optical linear encoders. Deployable in a multitude of applications, their innovative design eliminates the external motor housings that create mechanical clash points and impede access to the device being positioned.

The stages have a travel range of 30 mm on each of their axes, and can be positioned to an accuracy of 8.0 µm with bi-directional repeatability of ±1.0 µm, at speeds of up to 2.4 mm/s. The high-quality construction uses high-rigidity precision linear bearings, commercial grade limit switches, and powerful linear DC servo motors. In addition, the number of moving parts has been minimized, which optimizes their lifetime and reliability. Power is supplied via a single wall socket adapter (included).

The integrated DC controller allows for USB connectivity and provides easy 'Plug and Play' PC controlled operation - multiple units can be connected to a single PC via standard USB hub technology for multi-axis motion control applications. Coupling this with user friendly Kinesis® software (supplied) allows the user to get up and running with complex move sequences within a short space of time – facilitated by all relevant operating parameters being set automatically by the software. Advanced custom motion control applications and sequences are also possible using the extensive programming environment also supplied. This programming library is compatible with many development tools such as LabVIEW, Visual Basic, Visual C++, C++ Builder, LabWindows/CVI, MATLAB and Delphi.

## 1.2. Kinesis PC Software Overview

### 1.2.1. Introduction

The M30X(/M) and M30XY(/M) stages share many of the benefits of the Kinesis range of products. These include 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.

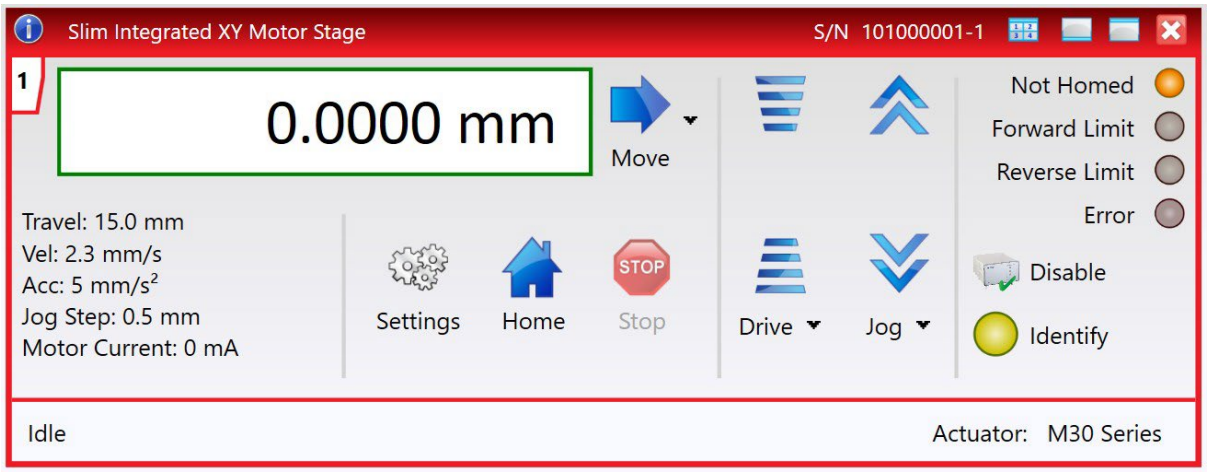
The User Interface allows full control of all settings and operating modes enabling complete 'out-of-box' operation without the need to develop any further custom software. It provides all of the necessary system software services such as generation of GUI panels, communications handling for multiple USB units, and logging of all system activity to assist in hardware trouble shooting. It is this Kinesis server 'engine' that is used by software developers to allow the creation of advanced automated positioning applications very rapidly and with great ease. The Kinesis server is described in more detail in Chapters 4 and 5.

### 1.2.2. Kinesis Server

Kinesis controls are re-usable compiled software components that supply both a graphical user interface and a programmable interface. Many such Controls are available for Windows applications development, providing a large range of re-usable functionality. For example, there are Controls available that can be used to manipulate image files, connect to the internet, or simply provide user interface components such as buttons and list boxes.

With the Kinesis system, .Net Controls are deployed to allow direct control over (and reflect the status of) the range of electronic controller units and stages, including the M30X(/M) and M30XY(/M) Integrated DC Servo-Driven stages. 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#.NET and, via VBA, Microsoft Office applications such as Excel and Word.

Consider the .Net Control supplied for the M30XY stage.




This Control provides a complete user graphical instrument panel to allow the motor unit to be manually operated, as well asa complete set of software functions (often called methods) to allow all parameters to be set and motor operations to be automated by a client application. The instrument panel reflects the current operating state of the controller unit to which it isassociated (such as motor position). Updates to the panel take place automatically when a user (client) application is making software calls into the same Control. For example, if a client application instructs the associated motor Control to move a motor, the progress of that move is reflected automatically by changing position readouts on the graphical interface, without the need for further programming intervention.

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 system online help or the handbooks associated with the controllers.

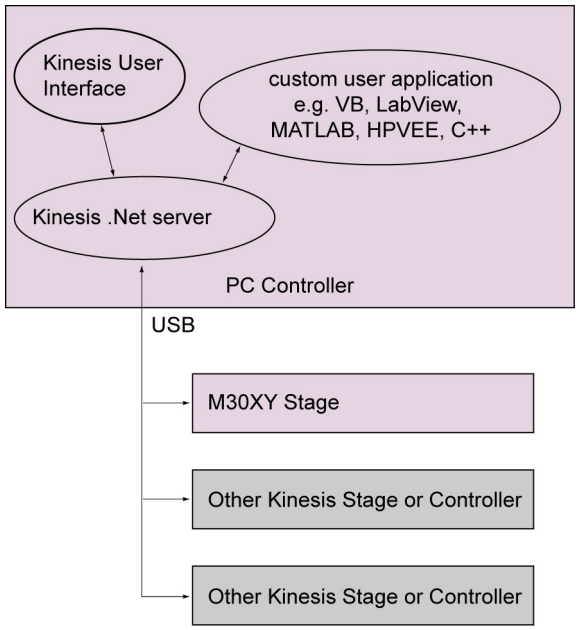



**Figure 1 System Architecture Diagram**

Refer to the main Kinesis Software online help file, for a complete programmer's 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.

### 1.2.3. Software Upgrades

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

# 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



**Warning**

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.

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.

The equipment is for indoor use only.

When running custom move sequences, or under fault conditions, the stage may move unexpectedly. Operators should take care when working inside the moving envelope of the stage.

# Chapter 3 Installation

## 3.1. 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 will interrupt communication between the Kinesis 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 Kinesis 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 user's 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 your local 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.

## 3.2. Mechanical Installation

### 3.2.1. Environmental Conditions

**Warning**

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

| | |
|---|---|
| Location | Indoor use only |
| Maximum altitude | 2000 m |
| Temperature range | 5°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.

he unit must not be used in an explosive environment.

### 3.3. Horizontal Mounting

Using a 2 mm (5/64") hex key as shown below, move the top platform to gain access to the mounting holes in the base plate, and secure using M6 or 1/4-20 bolts (not supplied).

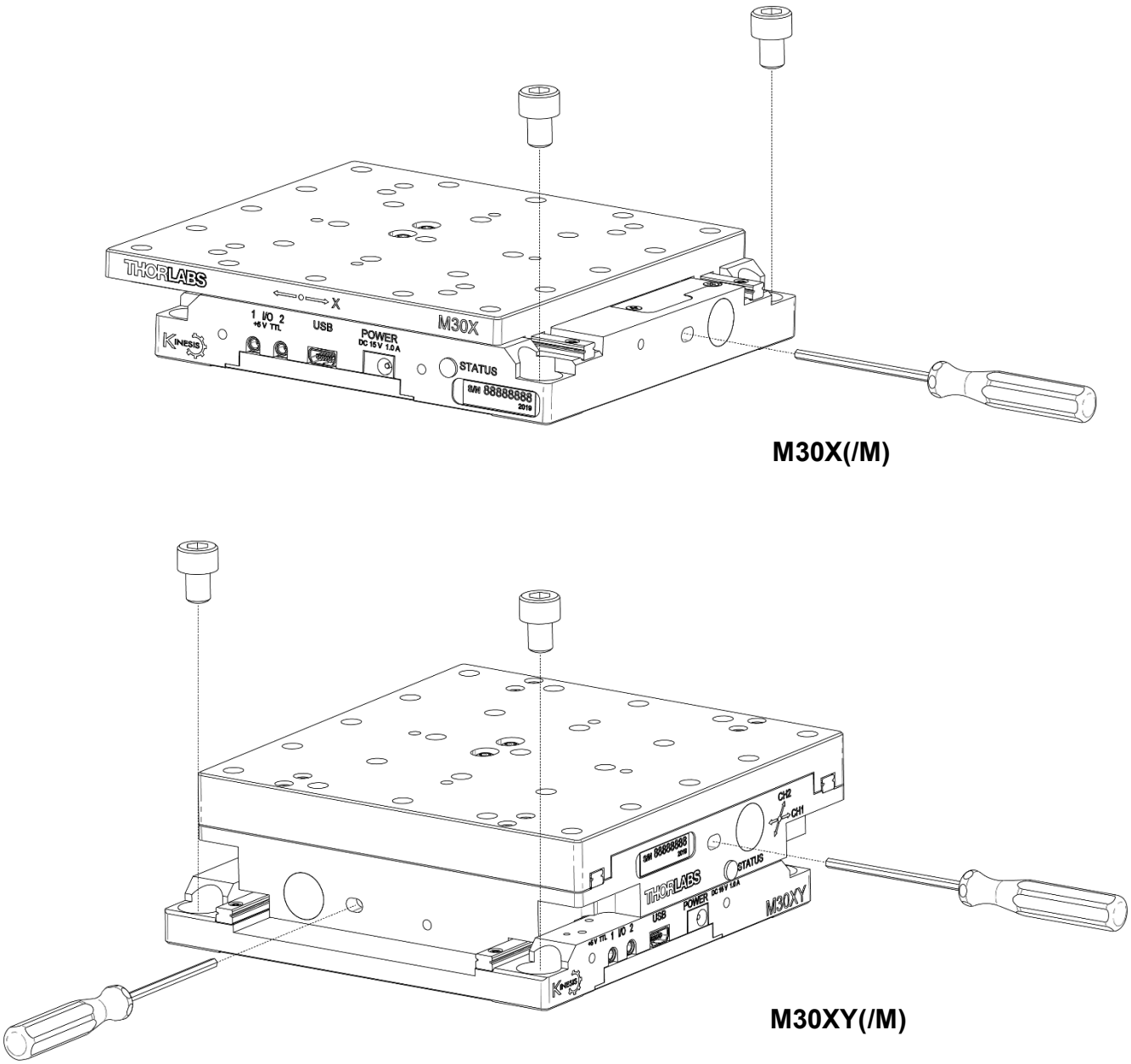



**Figure 2 Horizontal Mounting to the Worksurface**

**Caution**

When moving the stage manually using the hex key, move the stage slowly and gently, do not apply excessive torque.

When mounting components, or fitting the stage within an application, do not apply excessive pressure to the moving platform.

## 3.4. Vertical Mounting

The stages can be mounting in a vertical orientation using the M30A2(/M) adapter plate as shown below. It is recommended that the M30A1 cable clamp is also used as shown to support the cables.

**Caution**

When mounting vertically, the stage should be orientated only as shown below. Different orientations may place stresses on the internal components, especially when coupled with heavy loads.

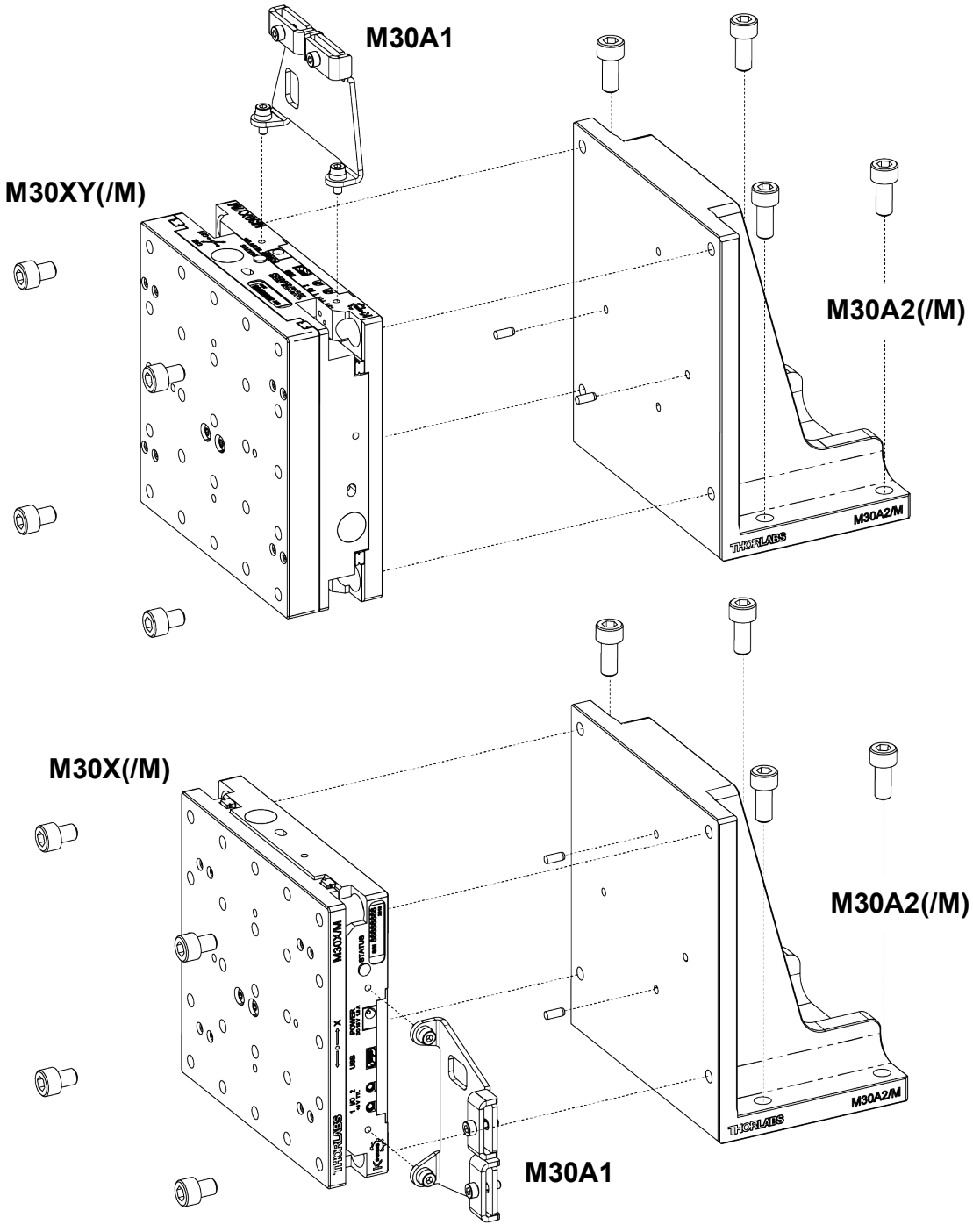



**Figure 3 Vertical Mounting**

1) Using four M6 (1/4-20) cap screws, fit the bracket to the work surface at the required position.
2) Fit the two alignment pins supplied to the mounting face of the angle bracket.

3) Offer the stage up to the mounting face of the angle bracket and ensure that the alignment pins mate properly into the locating holes in the underside of the stage.
4) Move the stage manually using a 2 mm (5/64") hex key sufficiently to gain access to the mounting holes, then fit four M6(1/4-20) cap screws to fit the stage to the bracket.
5) Fit the M30A1 cable clamping plate, then secure the cables

## 3.5. Connector Detail

The side of the unit is fitted with a number of connectors that are common for both M30X and M30XY, as shown in Figure 4.




**Figure 4 Power and USB Connectors for the X (top) and XY (below) stage versions**

**I/O 1 and I/O 2** - MMCX jack socket. These connectors can be independently configured for use with an external trigger input or output signal (5 V TTL levels).

The default state when the port is unconnected is High.

In output mode, the port provides a push-pull drive of 5 V with a maximum current of 8 mA.

An MMCX to BNC cable is supplied. MMCX to SMA (CA3439) adapters are available separately from www.thorlabs.com. Units are shipped with I/O functionality disabled. The function is set to trigger IN or OUT via the GUI settings panel.

**USB** – Mini-AB receptacle provides connection to the PC USB port or USB hub. The port is designed to mate with a 'USB Mini-B' type connector.

**POWER** - 3.5 mm jack socket for connecting the 15 V power supply unit (included).

**STATUS LED** - Provides an indication of various operating states as follows.

| LED Color | Meaning |
|---|---|
| Green | Powered up and stationary |
| Orange | In motion |
| Red | Error condition |
| Flashing | The Ident button on the associated GUI panel has been pressed |

If the LED is red, the error could be any of the following:

Motor disconnected / short circuit (wiring fault)

Supply voltage outside tolerance

Excessive motor current or overloaded motor

PWM driver over-temperature

Encoder fault

# Chapter 4 Operation

## 4.1. Introduction

The following brief tutorial guides the user through a typical series of moves and parameter adjustments performed using the software. It assumes that the unit is electrically connected as described in Section 4.2. and that the Software is already installed - see Section 3.1.

## 4.2. Connect The Hardware

1) Perform the mechanical installation as detailed in Section 3.2.
2) Install the Software.

**Caution**

During items (3) to (6) the instructions should be followed strictly in the order stated. Problems may occur if the process is not performed in the correct sequence.

3) Connect the stage unit to your PC.
(**Note**. The USB cable should be no more than 3 meters long. Communication lengths in excess of this can be achieved by using a powered USB hub).
4) Connect the stage unit to the power supply provided - see Section 3.5.
5) Connect the PSU to the mains power outlet and switch ON.
The unit takes about 5 seconds from power application until warm up is finished.
6) Windows™ should detect the new hardware. Wait while Windows™ installs the drivers for the new hardware.

**Note**

If any problems are encountered during the connection and power up process, power cycle the unit to clear the error.

## 4.3. Verifying Software Operation

### 4.3.1. Initial Setup

1) Run the software and check that the Graphical User Interface (GUI) panel appears and is active. For the M30X versions, only a single stage panel appears (Figure 5a) whereas for the M30XY version, 2 stage panels are shown, (Figure 5b): the number in the tab (circled) indicates the stage reference (1 = X; 2 = Y). *For the remainder of this manual, reference to only one of these panels is made.*

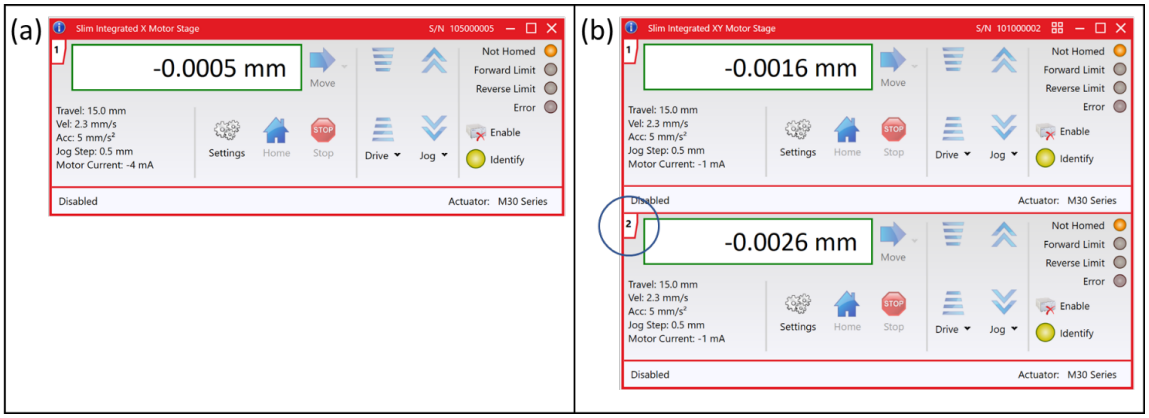



**Figure 5 GUI Panel for (a) Single Channel M30X and (b) Dual Channel M30XY**

2) Check that the correct stage type and serial number are displayed in the GUI panel.
3) Click the 'Ident' button. The STATUS LED on the side of the unit flashes - see Section 3.5. This is useful in multi-channel systems for identifying which driver unit is associated with which GUI.
4) Before any movement can be made, the motors need to be enabled, achieved by clicking on the Enable icon.
5) Click the jog buttons on the GUI panel and check that the associated stage moves. The position display for the associated GUI should increment and decrement accordingly.

Follow the tutorial steps described in the remainder of Chapter 4 for further verification of operation.

## 4.4. Homing Motors

Homing the motor moves the actuator to the home limit switch and resets the internal position counter to zero. The process can be achieved after powering up and enabling the motor.

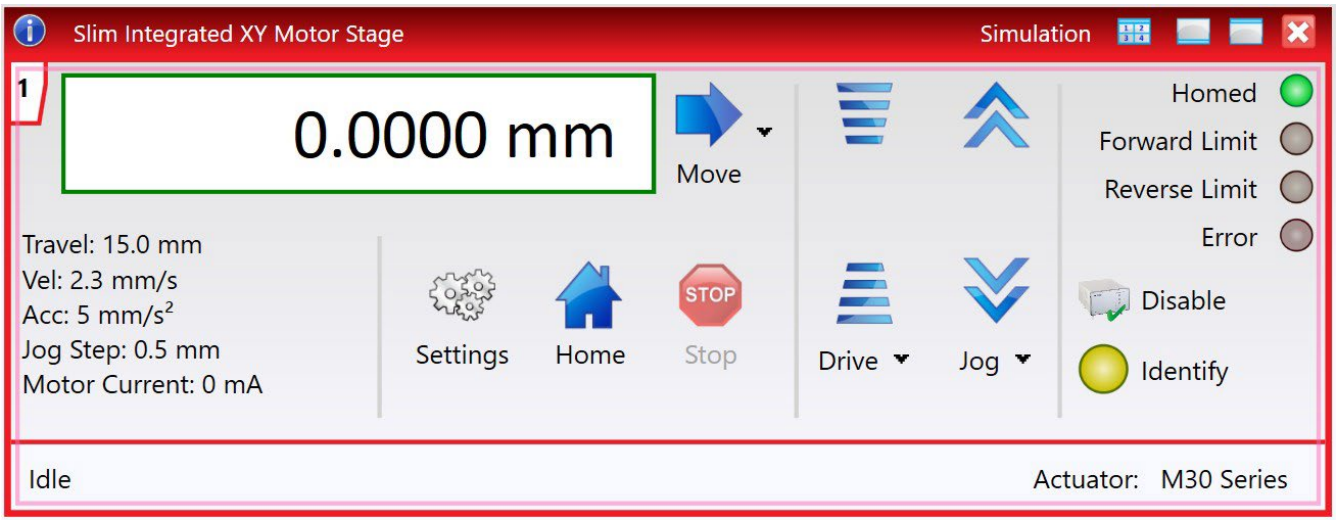



**Figure 6 M30XY Stage Software GUI**

1) Click the 'Home' button. Notice that the 'Not Homed' LED changes to 'Homed', and that the LED flashes to indicate that homing is in progress. The displayed position is arbitrary until the home position is reached, at which point the position indicator resets to 0.0000.

**Note**

After homing, shaft relaxation may cause a small position offset to be displayed. This relates only to one or two encoder counts and is not significant in terms of 'real world' positioning.

2) When homing is complete, the 'Homed' LED is lit as shown above.

## 4.5. Changing Motor Parameters and Moving to an Absolute Position

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

Moves are performed using a trapezoidal velocity profile. The velocity settings relate to the maximum velocities at which a move is performed, and the acceleration at which the motor speeds up from zero to maximum velocity.

1) On the GUI panel, click the Move arrow  to show the Settings panel

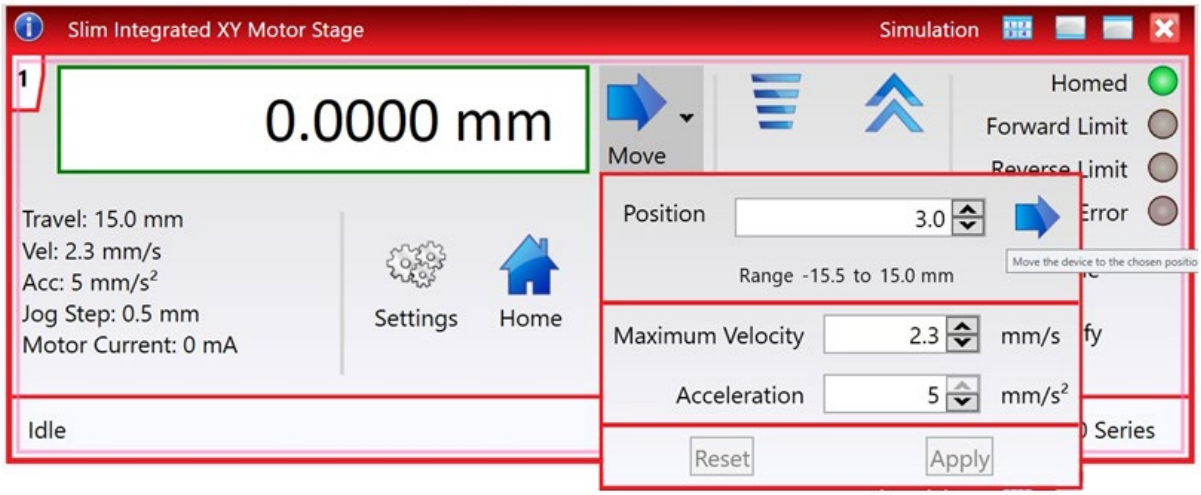



**Figure 7 Move Pop-Up Setting Panel**

2) Enter the required absolute position and/or parameter values.
3) To move to the position entered click the arrow 
4) Click 'Apply' to save the parameter settings and close the window, click Reset to return to the previously saved values.

## 4.6. Jogging

During PC operation, the motor actuators are jogged using the GUI panel arrow keys. There are two jogging modes available, 'Single Step' and 'Continuous'. In 'Single Step' mode, the motor moves by the step size specified in the Step Distance parameter. If the jog key is held down, single step jogging is repeated until the button is released - see Fig. 12. In 'Continuous' mode, the motor actuator will accelerate and move at the jog velocity while the button is held down.

1) On the GUI panel, click the arrow next to 'Jog' to display the Settings pop up window.

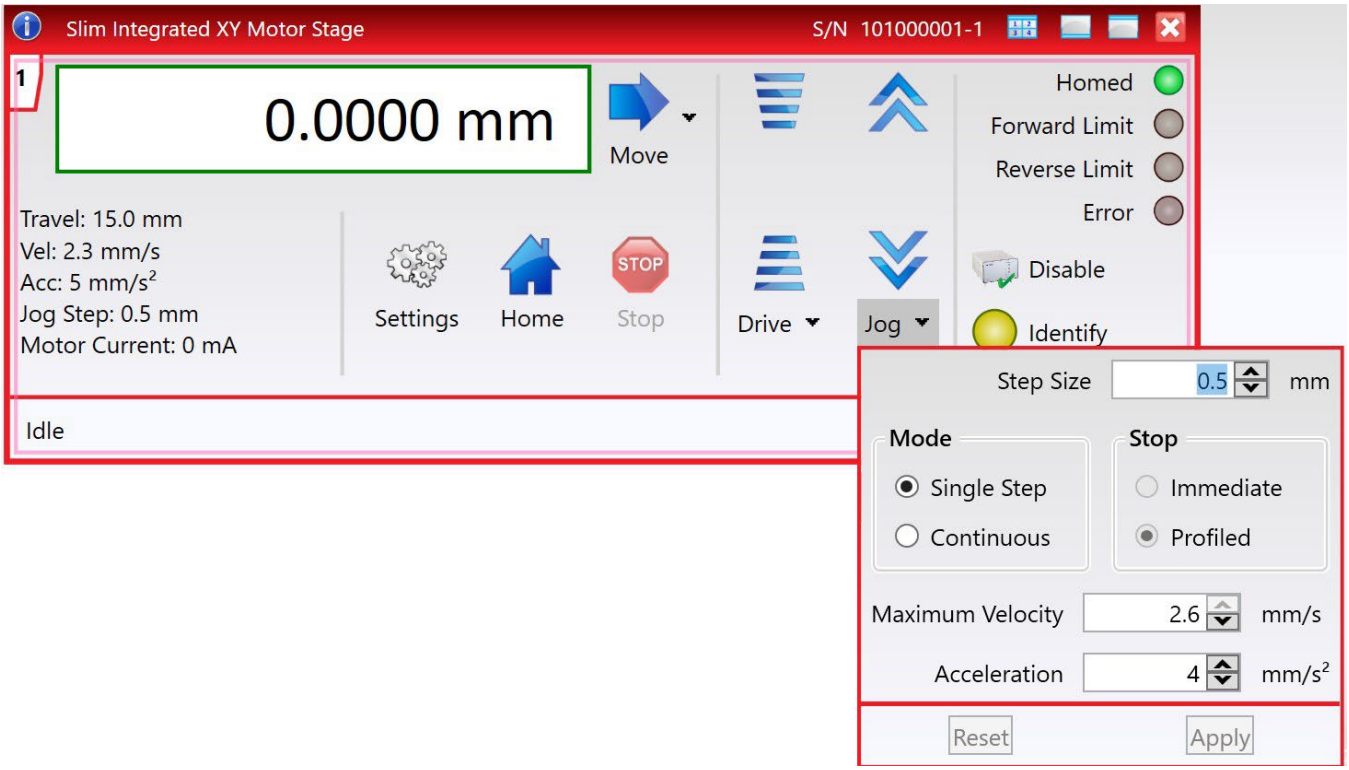



**Figure 8 Jog pop Up Settings**

2) Make parameter changes as required.

**Note**

In current versions of software, the 'Min Vel' parameter is locked at zero and cannot be adjusted.

3) Click 'Apply' to save the settings and close the window, click Reset to return to the previously saved values.

## 4.7. Setting Move Sequences

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

## 4.8. Changing and Saving Parameter Settings

During operation, certain settings (e.g. move 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 Start Up settings', must be created which can then be applied and/or uploaded on subsequent start up. See the *Kinesis Helpfile* for more details.

## 4.9. Stage/Axis Tab

This tab contains a number of parameters which are related to the physical characteristics of the particular stage or actuator being driven. They need to be set accordingly such that a particular stage is driven properly by the system.

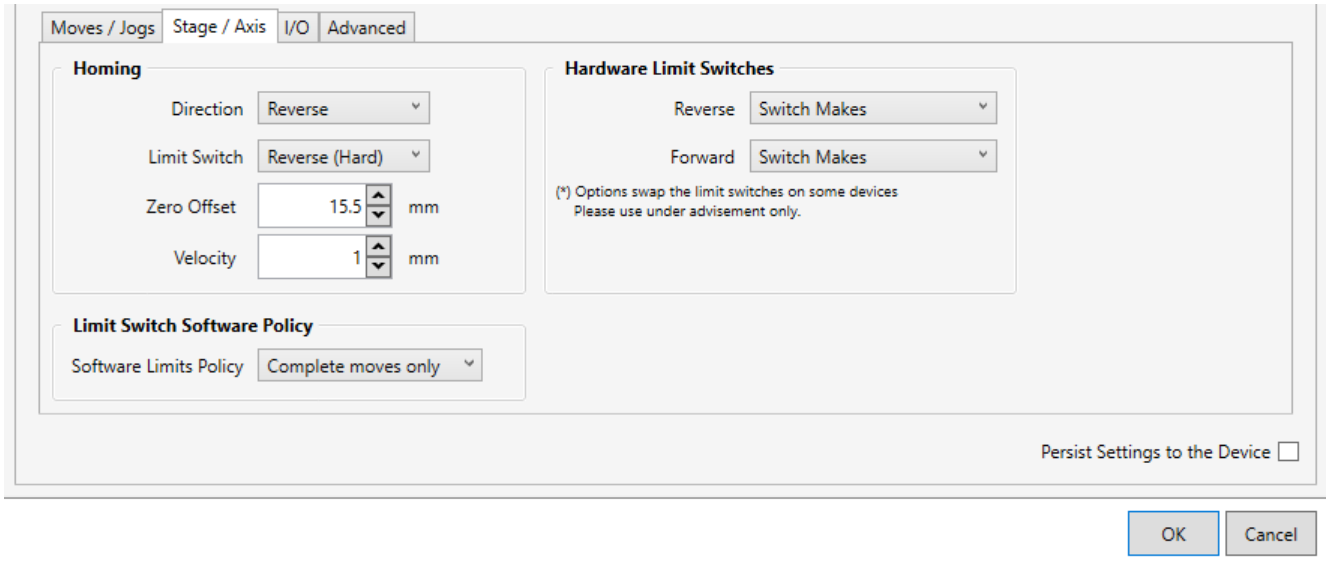



**Figure 9 Stage/Axis Tab**

These parameters were set automatically when the server automatically applied suitable defaults during boot up. These parameters should not be altered for pre-defined Thorlabs stages and actuators, as it may adversely affect the performance of the stage.

For third party stage types not available using the software, these stage details must be entered manually. Individual parameters are described in Section 5.3.

# Chapter 5 Software Reference

## 5.1. Introduction

This chapter gives an explanation of the parameters and settings accessed from the Kinesis software running on a PC. For information on the methods and properties which can be called via a programming interface, see the *Helpfile* for more details.

## 5.2. GUI Panel

The following screen shot shows the generic graphical user interface (GUI) displayed when accessing the M30X or M30XY Stages using the Kinesis software.

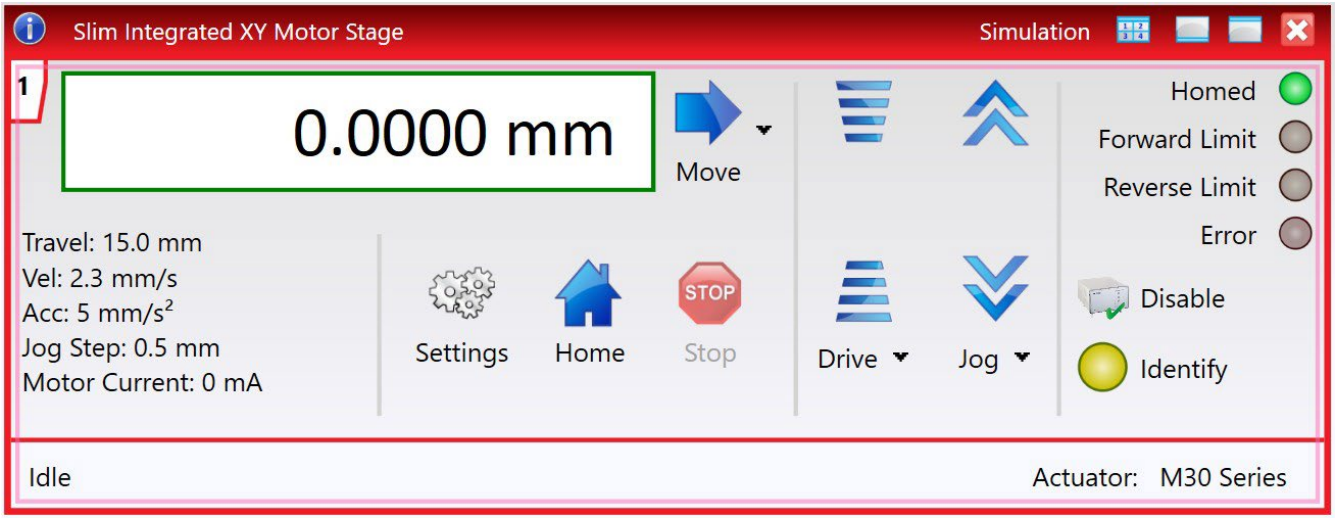


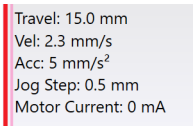

**Figure 10 M30XY Software GUI**




**Position window** - shows the position (in millimeters or degrees) of the motor. The motormust be 'Homed' before the display will show a meaningful value, (i.e. the displayed position is relative to a physical datum, the limit switch).

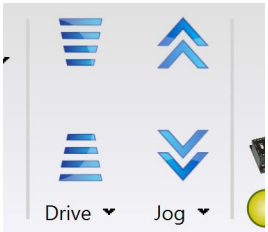
**Move** - Opens the settings window, so that position data and velocity parameterscan be entered - see Section 4.5. Moves are performed using the current velocity parameters which can be changed in the same panel. The present settings are displayed below the window.

**Velocity Parameters** - the present setting for the move velocity parameters and the jog step size. Thetravel range of the associated stage/actuator is also displayed.




These settings can be adjusted as described previously, or by clicking the Settings button to display the settings window, see Section 5.3.2.

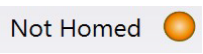
**Jog Controls** - used to increment or decrement the motor position.
The controls comprise a bargraph and a set of jog arrows.




Each division of the bar graph represents a different velocity. The velocities are entered in the settings panel which is displayed by clicking 'Drive' or the small down arrow.

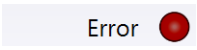
When the arrows are clicked, the motor is driven in the selected direction at the jog velocity, one step per click. The step size and jog velocity parameters can be changed by clicking 'Jog' or the small down arrow to display the settings panel.

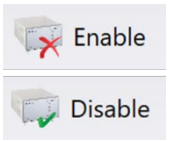
**Homed/Not Homed** - lit when the motor has not been 'Homed' since power up. When the home button is clicked, the caption changes to 'Homed' and the LED flashes while the home move is being performed. The LED is lit green once the move is complete.




**Forward/Reverse Limit** - lit when a limit switch is activated, i.e. the motor is at its end stop.

**Error** - lit when a fault condition occurs.

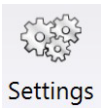



**Enable/Disable** - applies and removes power to the motor. With the motor enabled, only the Disable button is visible, and with the motor disabled only the Enable button is visible.




**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 5.3.




**Home** - sends the motor to its 'Home' position.




**Stop** - halts the movement of the motor.




**Lower Display** - Shows the present state of the motor, e.g. Idle, Moving,Moving EXT or Homing.

Also shows the part number of the associated actuator or stage.

## 5.3. Settings Panel

When the 'Settings' button on the GUI panel is clicked, the 'Settings' window is displayed. This panel allows motor operation parameters such as move/jog velocities, and stage/axis information to be modified. Note that all of these parameters have programmable equivalents accessible through the functions on this Control (refer to the *Kinesis API helpfile* for further details.

### 5.3.1. Persisting Settings to Hardware

Many of the parameters that can be set for the stage can be stored (persisted) within the unit itself, such that when the unit is next powered up these settings are applied automatically. To save the settings to hardware, check the '*Persist Settings to the Device'* checkbox before clicking the 'OK button.

**Caution**

The 'Persist Settings' functionality is provided to simplify use of the unit in the absence of a PC. When the unit is connected to a PC and is operated via the Kinesis software, the default settings will be loaded at boot up, even if the 'Persist Settings' option has been checked.

5.3.2. Moves/Jogs Tab

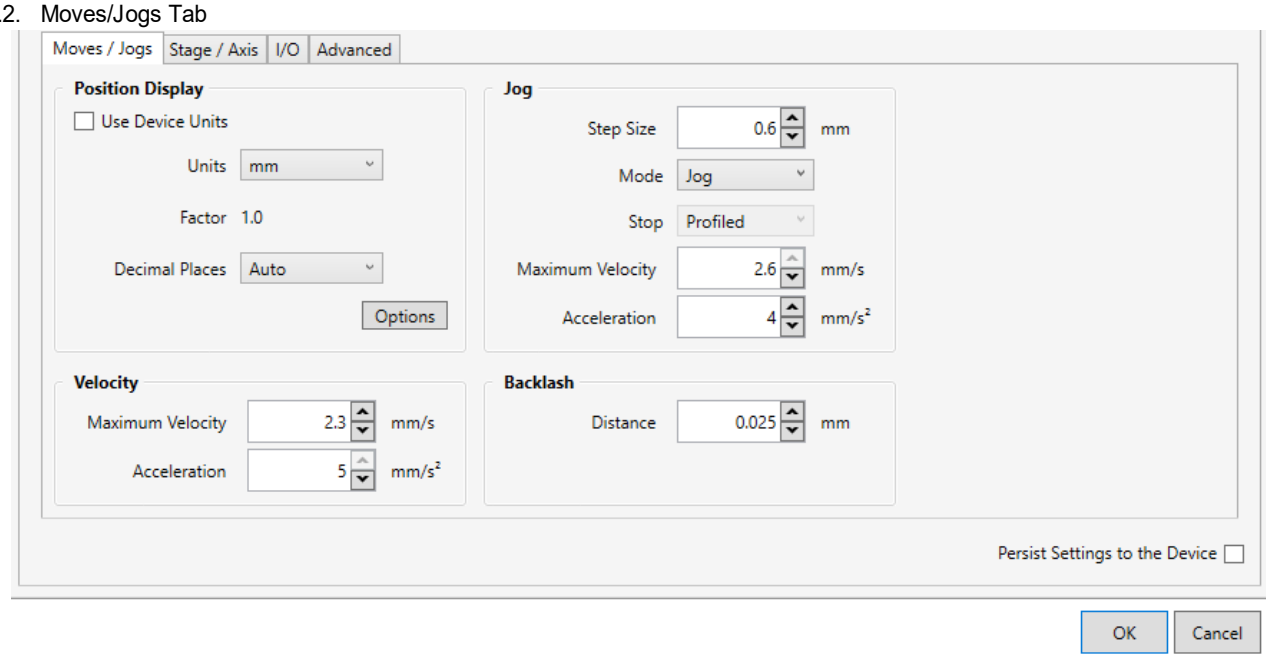



**Figure 11 Move/Jog Settings**

**Position Display**

By default, the GUI panel will display position in real world units (mm). If required, the units can be changed to so that the display shows other positional units (cm, µm, inch). If *Use Device Units* is checked, then the GUI will display in device units (i.e. encoder counts).

*Units* - the positioning units used on the GUI display.

*Factor* - the scaling factor associated with the selected units.

*Decimal Places* - the number of decimal places used in the position display.

**Jog Parameters**

Jogs are initiated by using the 'Jog' keys on the GUI panel (see Section 4.6.), or the Velocity Wheel on the top panel of the unit.

*Step Size* - The distance to move when a jog command is initiated. The step size is specified in real world units (mm or degrees dependent upon the stage).

*Mode* - The way in which the motor moves when a jog command is received (i.e. GUI panel button clicked).

There are two jogging modes available, 'Jog' and 'Continuous'. In 'Jog' mode, the motor moves by the distance specified in the Step Size parameter. If the jog key is held down, single step jogging is repeated until the button is released - see Fig. 5.3. In 'Continuous' mode, the motor actuator will accelerate and move at the jog velocity while the button is held down.

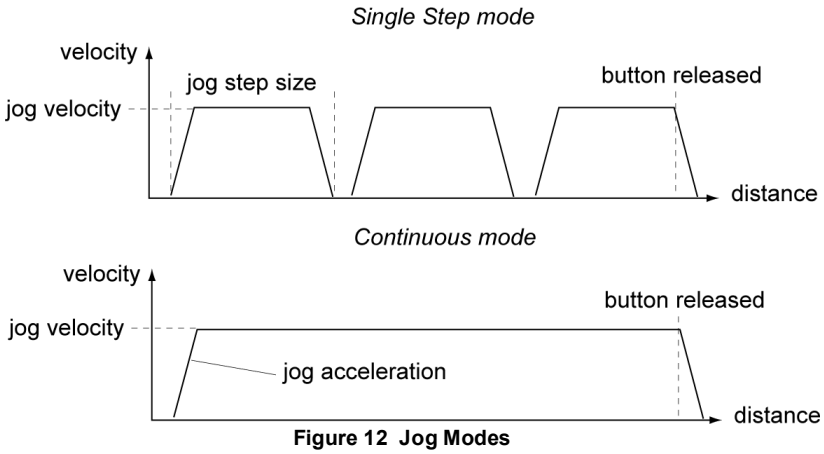



**Figure 12 Jog Modes**

*Jog* - the motor moves by the distance specified in the Step Size parameter.

*Continuous* - the motor continues to move until the jog signal is removed (i.e. jog button is released).

*Stop* - the way in which the jog motion stops when the demand is removed.

*Immediate* - the motor stops quickly, in a non-profiled manner

*Profiled* - the motor stops in a profiled manner using the jog Velocity Profile parameters set above.

*Maximum Velocity* - the maximum velocity at which to perform a move.

*Acceleration* - the rate at which the velocity climbs from zero to maximum, and slows from maximum to zero.

**Velocity Parameters**

Moves can be initiated via the GUI panel by entering a position value after clicking on the position display box (see Section 4.5.), or by calling a software function (see the *Kinesis API helpfile*). The following settings determine the velocity profile of such moves, and are specified in real world units, millimeters or degrees.

*Maximum Velocity* - the maximum velocity at which to perform a move.

*Acceleration* - the rate at which the velocity climbs from zero to maximum, and slows from maximum to zero.

**Note**

Under certain velocity parameter and move distance conditions, the maximum velocity may never be reached (i.e. the move comprises an acceleration and deceleration phase only).

**Backlash**

*Distance* - The system compensates for lead screw backlash during reverse direction moves, by moving passed the demanded position by a specified amount, and then reversing. This ensures that positions are always approached in a forward direction. The Backlash Distance is specified in real world units (millimeters or degrees). To remove backlash correction, this value should be set to zero

5.3.3. Stage/Axis Tab

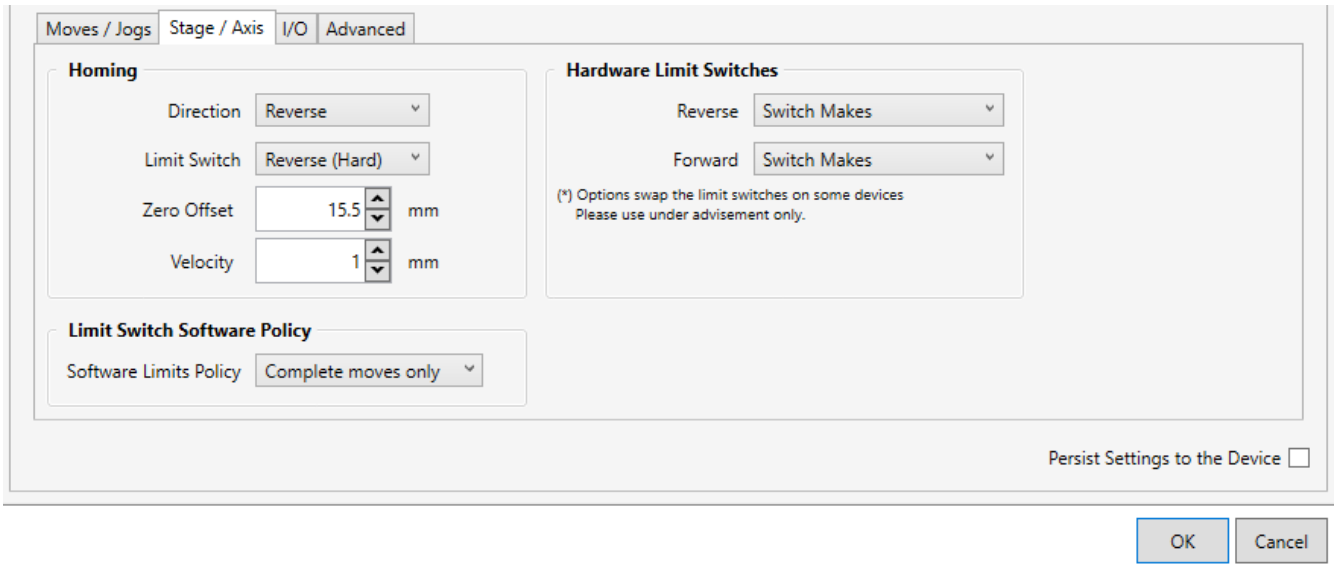



**Figure 13 Stage/Axis Settings**

**Note**

This tab contains a number of parameters which are related to the physical characteristics of the particular stage being driven. They need to be set accordingly such that a particular stage is driven properly by the system.

The Kinesis software will automatically apply suitable defaults for the parameters on this tab during boot up of the software and these parameters cannot be altered subsequently as it may adversely affect the performance of the stage. Descriptions are provided for information only.

For custom stage types not available using the Kinesis software, the stage details must be entered manually - see the

**Homing**

When homing, a stage typically moves in the reverse direction, (i.e. towards the reverse limit switch). The following settings allow support for stages with both Forward and Reverse limits.

**Note**

Typically, the following two parameters are set the same, i.e. both Forward or both Reverse.

*Direction* - the direction sense to move when homing, either *Forward* or *Reverse*.

*Limit Switch* - The hardware limit switch associated with the home position, set to *Forward (Hard), Reverse (Hard)* or *Ignore*.
*Zero Offset* - the distance offset (in mm or degrees) from the limit switch to the Home position.

*Velocity* - the maximum velocity at which the motors move when Homing.

**Hardware Limit Switches**

**Note**

The minimum velocity and acceleration/deceleration parameters for a home move are taken from the existing move velocity profile parameters.

The operation of the limit switches is inherent in the design of the associated stage or actuator. The following parameters notify the system to the action of the switches when contact is made. Select Rev Switch or Fwd Switch as required, then select the relevant operation.

*Switch Makes* - The switch closes on contact

*Switch Breaks* - The switch opens on contact

*Ignore/Absent* - The switch is missing, or should be ignored.

5.3.4. I/O Tab




**Figure 14 Triggering Settings**

**IO Introduction**

The stages have two bidirectional IO ports (IO1 and IO2) that can be used to read an external logic signal or output a logic level to control external equipment. Either of them can be independently configured as an input or an output and the active logic state can be selected High or Low to suit the requirements of the application. Electrically, the ports output 5 Volt logic signals and are designed to be driven from a 5 Volt logic.

For the input, a voltage level less than 1.5 V is recognized as logic Low, and a level greater than 3.5 V is registered as logic High. As the input contains a weak pull-up, the state of the input with nothing connected will default to a logic High. The weak pull-up feature allows a passive device, such as a mechanical switch to be connected directly to the input.

When the port is used as an output it provides a push-pull drive of 5 Volts, with the maximum current limited to approximately 8 mA. The current limit prevents damage when the output is accidentally shorted to ground or driven to the opposite logic state by external circuity.

Warning: do not drive the TRIG ports from any voltage source that can produce an output in excess of the normal 0 to 5 Volt logic level range. In any case the voltage at the TRIG ports must be limited to -0.25 to +5.25 Volts.

**Input Trigger Modes**

When configured as an input, the TRIG ports can be used as a general purpose digital input, or for triggering a relative, absolute or home move. When used for triggering a move, the port is edge sensitive. In other words, it has to see a transition from the inactive to the active logic state (Low->High or High->Low) for the trigger input to be recognized. For the same reason a sustained logic level will not trigger repeated moves. The trigger input has to return to its inactive state first in order to start the next trigger. The mode is set in the *Trig 1 Mode* and *Trig 2 Mode* parameters as follows:

*Disabled* - The trigger IO is disabled

*IN - GPI* - General purpose logic input (read through status bits using the software messages).

*IN - Relative Move* - Input trigger for relative move.

*IN - Absolute Move* - Input trigger for absolute move.

*IN - Home* - Input trigger for home move.

*IN - Stop* - Input trigger for stopping a move.

**Output Trigger Modes**

When the *Trigger 1 Mode* and *Trigger 2 Mode* parameters are configured as outputs, the TRIG ports can be used as a general purpose digital output, or to indicate motion status or to produce a trigger pulse at configurable positions as follows:

*OUT GPO* - General purpose logic output.

*OUT - In Motion* - Trigger output active (level) when motor 'in motion'. The output trigger goes high (5V) or low (0V) (as set in the Trig 1. Polarity and Trig. 2 Polarity parameters) when the stage is in motion.

*OUT - At Max Velocity* - Trigger output active (level) when motor at 'max velocity'.

*OUT - At Position Steps Fwd* - Trigger output active (pulsed) at pre-defined positions moving forward. Only one Trigger port at a time can be set to this mode. See Trigger Out Position Steps for further details.

*OUT - At Position Steps Rev* - Trigger output active (pulsed) at pre-defined positions moving backwards. Only one Trigger port at a time can be set to this mode. See Trigger Out Position Steps for further details.

*OUT - At Position Steps Both* - Trigger output active (pulsed) at pre-defined positions moving forwards and backward. Only one Trigger port at a time can be set to this mode. See Trigger Out Position Steps for further details.

*OUT - At Forward Limit* - Trigger output active (pulsed) when the forward limit switch is activated.*OUT - At Reverse Limit* - Trigger output active (pulsed) when the reverse limit switch is activated.*OUT - At Limit* - Trigger output active (pulsed) when the either limit switch is activated.

**Trigger Out Position Steps**

**Note**

If the trigger mode is not set to one of the three position step modes described previously, then the following parameters are not applicable and will be hidden.




As soon as a position triggering mode is selected on either of the IO ports, the port will assert the inactive logic state, set in the IO Polarity parameters.

As the stage moves in its travel range and the actual position matches the position set in the Trigger Start Position parameter, the IO port will output its active logic state. The active state will be output for the length of time specified by the Trigger Pulse Width parameter, then return to its inactive state and schedule the next position trigger point at the Trigger Start Position value plus the value set in Trigger Interval parameter.

Thus when this second position is reached, the TRIG output will be asserted to its active state again. The sequence is repeated the number of times set in the Trigger Count parameter.

When the number of pulses set in the Trigger Count parameter has been generated, the trigger engine will schedule the next position to occur at the position specified in the Reverse Trigger Start Position parameter. The same sequence as the forward direction is now repeated in reverse, except that the Reverse setting parameters apply. When the number of pulses has been output, the entire forward-reverse sequence will repeat the number of times specified by Trigger Cycle Count parameter. This means that the total number of pulses output will be Trigger Cycle Counts x (Forward Trigger Count + Reverse Trigger Count).

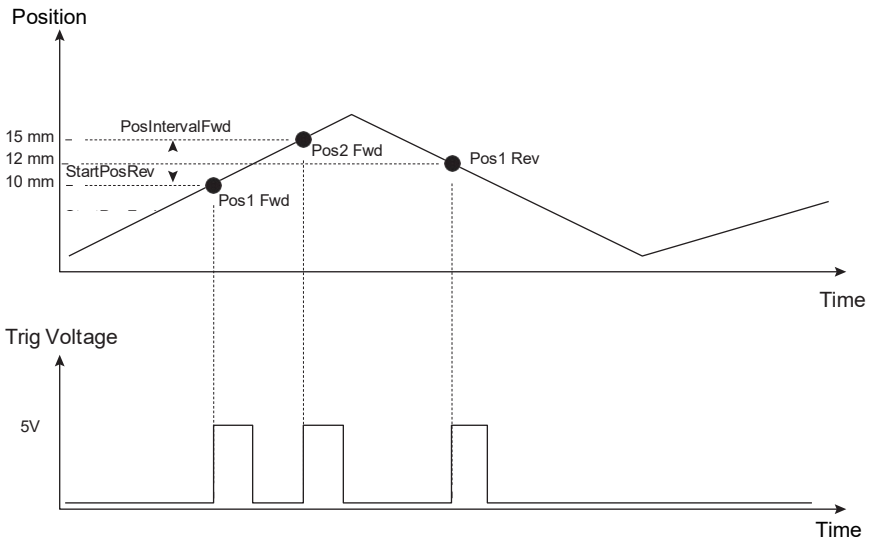



**Figure 15 Position Steps Triggering**

Example for a move from 0 to 20 mm and back.

In forward direction: The first trigger pulse occurs at 10 mm (StartPosFwd), the next trigger pulse occurs after another 5 mm (PosIntervalFwd), the stage then moves to 20 mm.

In reverse direction: The next trigger occurs when the stage gets to 12 mm.

Note that position triggering can only be used on one TRIG port at a time, as there is only one set of position trigger parameters.

*Trigger Polarity*

The polarity of the trigger pulse is specified in the *Trigger 1 Polarity* and *Trigger 2 Polarity* parameters as follows:

*Trigger High* - The active state of the trigger port is logic HIGH 5V (trigger input and output on a rising edge).

*Trigger Low* - The active state of the trigger port is logic LOW 0V (trigger input and output on a falling edge).

5.3.5. Advanced Tab

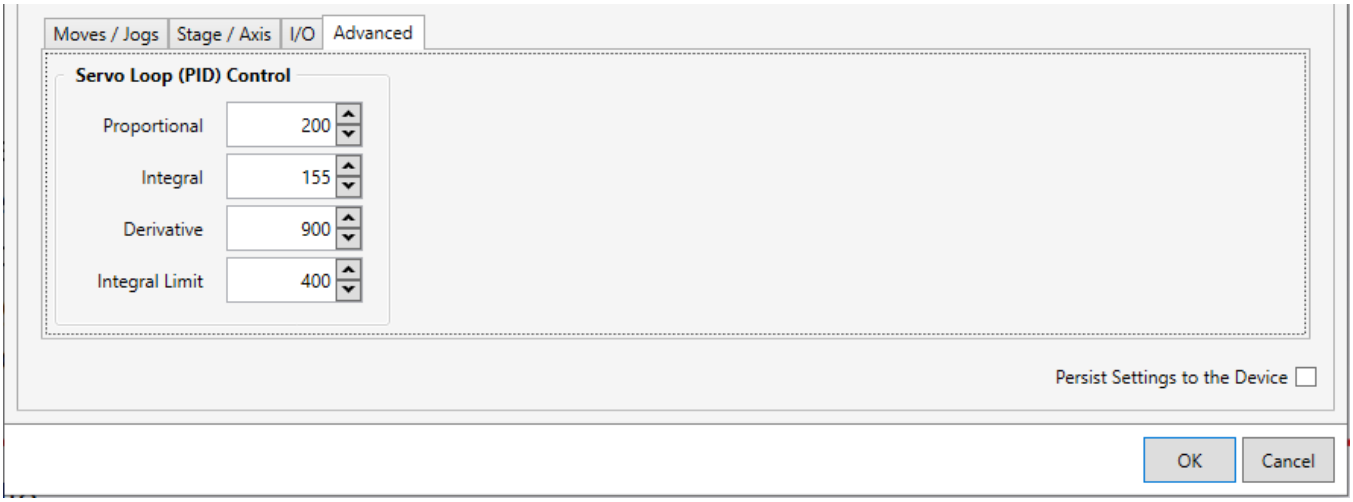



**Figure 16 Advanced Settings**

**Servo Loop (PID) Control Settings**

The M30X(/M) AND M30XY(/M) stages implement a full servo control loop for motor velocity and position control. The loop response to demanded position moves is determined via Proportional, Integration and Derivative settings. These settings can be altered using the 'Servo Loop (PID) Control Settings' parameters.

*Proportional* – This parameter makes a change to the output which is proportional to the positional error value. A high proportional gain results in a large change in the output for a given error. It accepts values in the range 0 to 65535.

*Integral* – This parameter accelerates the process towards the demanded position, ensuring that the positional error is eventually reduced to zero. If set too high, the output can overshoot the demand value. Under a constant torque loading, thestatic position error is zero. It accepts values in the range 0 to 65535.

*Derivative* – This term provides the 'damping' force proportional to the rate of change of the position error, thereby decreasing the overshoot which may be caused by the integral term. However, the differential term also slows down system response.

It accepts values in the range 0 to 65535.

*Integral Limit* – This term sets a maximum limit for the integration term to prevent an excessive build up over time of the restoring force. It accepts values in the range 0 to 65535.

**Note**

The default values programmed into the Kinesis software will give acceptable motor performance in most cases and should be changed only with extreme caution. The recommended PID settings for typical loads are shown below

| PID | Zero kg | 2.0 kg | 5.0 kg |
|---|---|---|---|
| Proportional | 200 | 200 | 70 |
| Integral | 155 | 155 | 80 |
| Derivative | 900 | 1000 | 900 |
| Integral Limit | 400 | 10 | 15 |

# Chapter 6 Preventive Maintenance

**Warning: Risk of Electrical Shock**

The equipment contains no user serviceable parts. There is a risk of electrical shock if the equipment is operated with the covers removed. Only personnel authorized by Thorlabs Ltd and trained in the maintenance of this equipment should remove its covers or attempt any repairs or adjustments. Maintenance is limited to safety testing and cleaning as described in the following sections.

## 6.1. Cleaning

**Warning**

Disconnect the power supply before cleaning the unit.Never allow water to get inside the case.

Do not saturate the unit.

Do not use any type of abrasive pad, scouring powder or solvent, e.g. alcohol or benzene.

The external surface may be cleaned with a soft cloth, lightly dampened with water or a mild detergent.

# Chapter 7 Specifications

## 7.1. M30X(/M) and M30XY(/M) Specifications

| Parameter | M30X(/M) | M30XY(/M) |
|---|---|---|
| **Stage Specifications** | | |
| Travel | 30 mm (1.18") | 30 mm x 30 mm (1.18" x 1.18") |
| Max Speed | 2.4 mm/s | |
| Acceleration | 5.0 mm/s$^2$ | |
| Bidirectional Repeatability | ±1.0 µm | |
| Backlash [a] | N/A | |
| Min Repeatable Incremental Movement | 2.5 µm | |
| Home Location Accuracy | ±1.75 µm | |
| Max Load Horizontal Mounting | 5.0 kg (11.02 lbs) | |
| Max Load Vertical Mounting | 2.0 kg (4.41 lbs) | |
| Accuracy | 8 µm | |
| Pitch Angular Deviation | ±100 µrad | |
| Yaw Angular Deviation | ±50 µrad | |
| Horizontal Straightness | ±2.5 µm | |
| Vertical Straightness | ±2.5 µm | |
| Limit Switches | X as Standard | X and Y as Standard |
| Bearing Type | High Rigidity Recirculating Precision Linear Bearing | |
| Motor Type | Brushed DC Motor | |
| **Motor Output** | | |
| Motor Drive Voltage | ±15 V | |
| Motor Drive Current *per axis*, loaded [b] | <100 mA (horizontal movement), <150 mA (vertical movement) | |
| Control Algorithm | Digital PID Filter (16 bit) | |
| Position Counter | 32 bit | |
| Velocity Profile | Trapezoidal | |
| **Input Power Requirements** | | |
| Voltage | 15 V Regulated DC | |
| Current | 500 mA (peak) | |
| **General Data** | | |
| Dimensions (W x D x H) at Mid Travel | 115 mm x 115 mm x 25 mm (4.53" x 4.53" x 0.98") | 115 mm x 115 mm x 40 mm (4.53" x 4.53" x 1.57") |
| Weight | 0.8 kg (1.76 lbs) | 1.2 kg (2.65 lbs) |

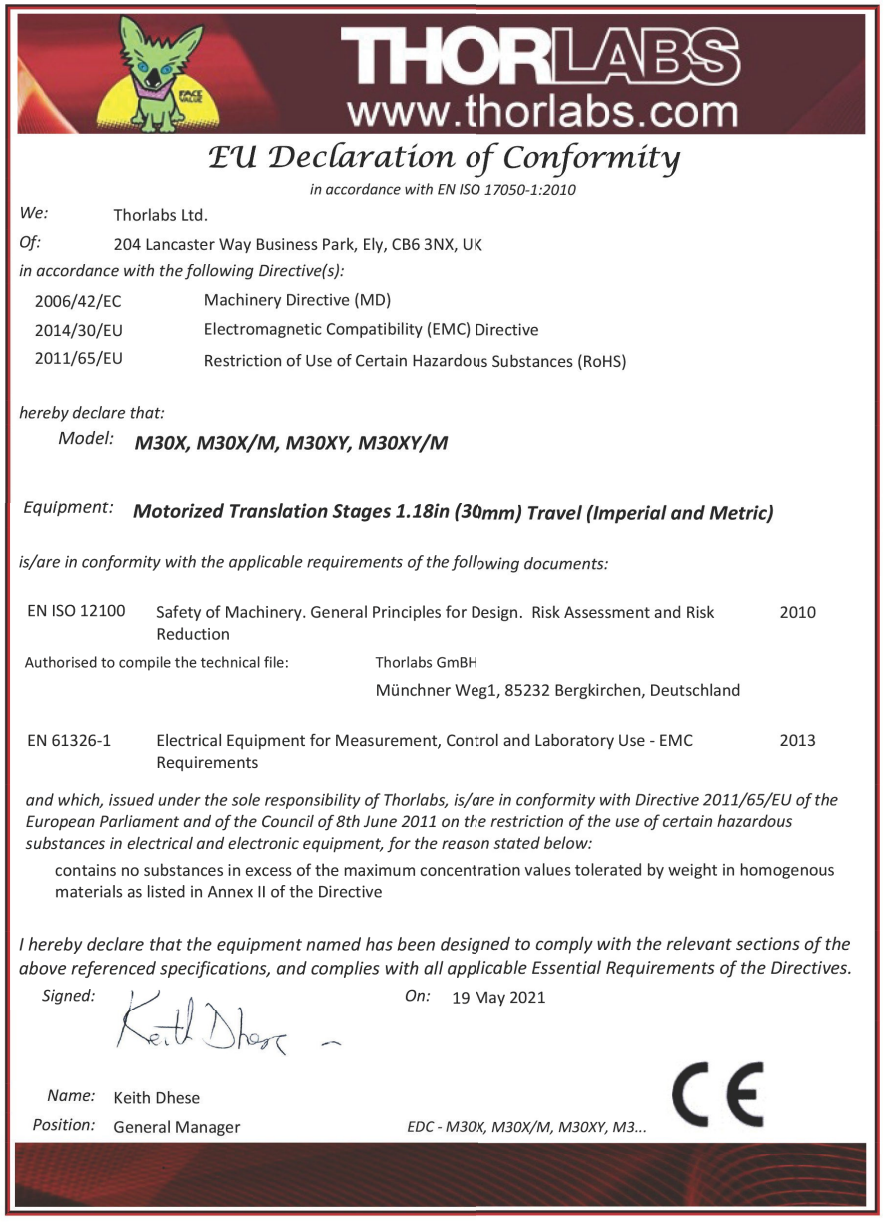
**Note:**

[a] The encoders used measure absolute position of the stages, which is a parameter independent of backlash.
[b] Each unit draws a further 100 mA for driving the microprocessor, LED etc., irrespective of whether the motors are in motion.

# Chapter 8 Regulatory

## 8.1. Declarations Of Conformity

### 8.1.1. For Customers in Europe



THORLABS
www.thorlabs.com

EU Declaration of Conformity

*in accordance with EN ISO 17050-1:2010*

*We:* Thorlabs Ltd.

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

*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:* ***M30X, M30X/M, M30XY, M30XY/M***

*Equipment:* ***Motorized Translation Stages 1.18in (30mm) Travel (Imperial and Metric)***

*is/are 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 |
| Authorised to compile the technical file: | Thorlabs GmBH<br>Münchner Weg1, 85232 Bergkirchen, Deutschland | |
| EN 61326-1 | Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements | 2013 |

*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:*

contains no 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 May 2021

*Name:* Keith Dhese

*Position:* General Manager

*EDC - M30X, M30X/M, M30XY, M3...*

CE

### 8.1.2. 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 9 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**
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**France**
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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.



***Annex I***




THORLABS

www.thorlabs.com