THORLABS

DRV225 and DRV250 Stepper Motor Actuators

User Guide



Contents

Chaper 1 Overview **1**
1.1 Description ***1***

Chaper 2 Safety **2**
2.1 Safety Information ***2***
2.2 General Warnings ***2***

Chaper 3 Operation and Maintenance **4**
3.1 Environmental Conditions ***4***
3.2 Fitting the Motor Actuator ***4***
3.3 Selecting the Stage Type ***5***
3.4 Maintenance ***6***
3.5 Pin Assignments ***7***
3.6 Extension Cables ***7***

Chaper 4 Specifications **8**
4.1 Specifications ***8***
4.2 How to Calculate the Linear Displacement ***8***

Chaper 5 Regulatory **9**
5.1 Declarations Of Conformity ***9***
5.1.1 For Customers in Europe 9
5.1.2 For Customers in the USA 9

Chaper 6 Thorlabs Worldwide Contacts **10**

Chapter 1 Overview

1.1 Description

These motor actuators offer 1" (25 mm) and 2” (50 mm) of travel, and when used with one of our stepper motor controllers, such as the BSC201, can achieve a default maximum speed of 50 mm/s. They provide sufficient torque for large loads up to 180 N.

The hybrid stepper motor, with its rotor consisting of 50 individual magnetic teeth, is ideally suited for micro-stepping applications. Aside from the obvious increase in resolution resulting from increasing the steps per revolution from 200 to 409,600, micro-stepping also ensures smoother low-speed motion by allowing the discrete 1.8º step size, which produces mechanical noise, to be reduced to much smaller steps with inherently lower resultant vibrational noise, achieving a theoretical minimum step size of 2.4×10^{-6} mm.

The Stepper Motor drive has been equipped with a trapezoidal screw thread for more efficient, high load operation than is available from a standard threading.

The actuators are compatible with our 2" LNR50M and LNR50DD manual stages. To use the actuator with these stages, remove the existing manual drive and mount the motor to the side of the stage using two M4 x 40 cap screws (included) - see Section 3.2.

The knob on the rear shaft of the motor is an inertial damper. When the actuator is powered down, It can also be used to position the actuator manually.

Note

Manually adjusting the actuator will cause the position to no longer be synchronized to the position display in the control software - this can lead to overrunning travel limits unexpectedly. If the actuator is powered down and moved by hand, ensure that it is homed immediately after power up.

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.

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

These Motorized Actuators can generate high forces. If handled improperly, they may cause injury. Be aware that failure of the motor controller may drive the unit into a hard stop and cause damage to the unit.

To avoid injury never put anything in the gap between the Actuator and any rigid structure.

Because it can be software controlled it should be noted that this device could begin to move unexpectedly for a person within its envelope of operation, who had not programmed the move.



Warning

The actuator may heat up when operated, and this is indicated by the warning hot surface symbol  on the product engraving.

Increased speeds, high duty cycles, and ambient temperature will all affect the temperature of the actuator. Special care should be taken when handling the product under these conditions, in particular when touching the damping knob and motor body.



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 absorbant tissue. Do not allow spilled fluid to enter the internal mechanism.

The equipment is for indoor use only.



Caution

If the actuator encounters a hard stop while still in the middle of its range (i.e. a translation stage at the end of its travel range), the motor should be stopped as soon as possible to prevent damage and to keep the unit from overheating

Caution

When storing these units, be sure to fully retract the lead screw to protect the threads from damage. Improper connection of the motor will result in permanent damage. All power supplied to the motor should be turned off before altering any connections to the motor. Check all connections before supplying power to the motor.

Caution

If the control PC used to operate the driver for the DRV225 and DRV250 actuators is running Thorlabs' Kinesis® software, version 1.14.20 or higher must be used. Earlier versions of the software do not support these products.

Chapter 3 Operation and Maintenance

3.1 Environmental Conditions

Caution

This unit is design for operation within normal operating conditions. It is not recommended to use this equipment outside the following limits.

Location	Indoor use only
Maximum altitude	2000 m
Temperature range	5 to 40 °C (41 to 104 °F)
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 must not be used in an explosive environment.

3.2 Fitting the Motor Actuator

The actuator is designed for fitting to an LNR50 series stage.

Referring to Fig. 3.1...

1) Loosen the mounting block actuator pinch bolts.
2) Remove the existing drive.
3) Loosen the actuator mounting block fixing bolts, and remove the mounting block together with its bolts.
4) Using the screws supplied with the motor, fit the motor actuator to the stage.
5) Adjust the actuator to its center position.
6) Loosen the push block pinch bolts and position the push block such that the stage is in its center of travel.
7) Tighten the push block pinch bolts.

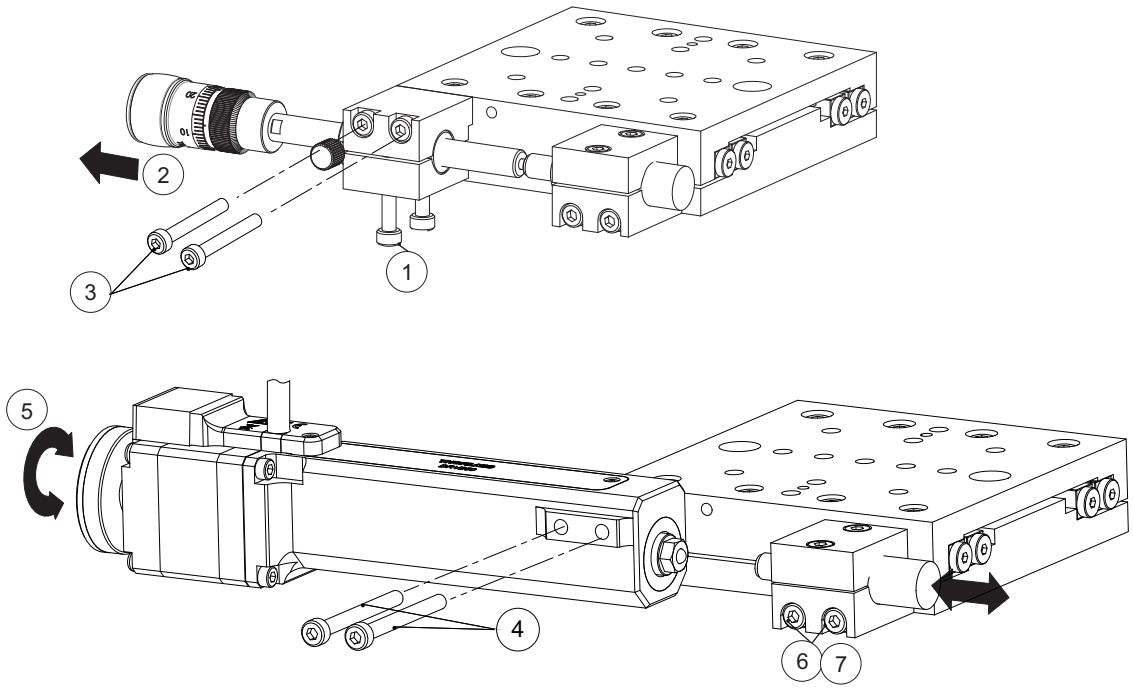


Fig. 3.1 Fitting a Motor Drive

Caution

When a DRV225 or DRV250 motor actuator is fitted, the stage must be fitted with an LNR50P4(/M) baseplate before it is fitted to the work surface - see www.thorlabs.com for more information. The legacy LNR50P1 baseplates are not compatible with these motors.

3.3 Selecting the Stage Type

To ensure that a particular stage is driven properly by the system, a number of parameters must first be set. These parameters relate to the physical characteristics of the stage being driven (e.g. min and max positions, leadscrew pitch, homing direction etc.).

To assist in setting these parameters correctly, it is possible to associate a specific stage type and axis with the motor controller channel. Once this association has been made, the server applies automatically, suitable default parameter values on boot up of the software.

Note

To ensure correct operation, it is important to select the correct stage and axis type as described above. Selecting an incompatible stage/axis type could result in reduced velocity and/or resolution, and in the worst case could cause the motor to run into the end stops or home incorrectly.

The section below describes selecting the stage using Thorlabs' Kinesis software. When using the actuators with the BSC202 or BSC203 controller, Thorlabs' XA software application can also be used. Please see the associated controller manuals for more information.

Using Kinesis Software

1) Install the electronic hardware and connect the modules to the relevant axes of the associated stages (see the handbooks for the associated controller).
2) Ensure that the device is connected to the PC and powered up.
3) Run the Kinesis software - Start/All Programs/Thorlabs/Kinesis/Kinesis.
4) On start-up, the 'Actuator/Startup Settings' window is displayed This window allows the correct actuator to be selected.

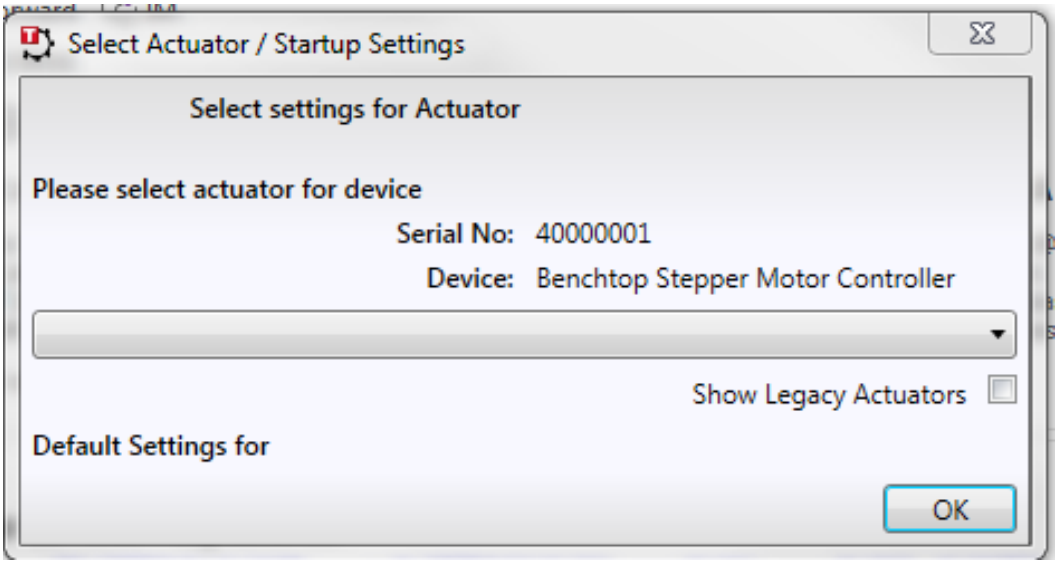


Fig. 3.2 Select Actuator Stage Settings Window - 1

5) Click the arrow to the right of the window, and select the actuator type (i.e. DRV225 or DRV250) from the list displayed.

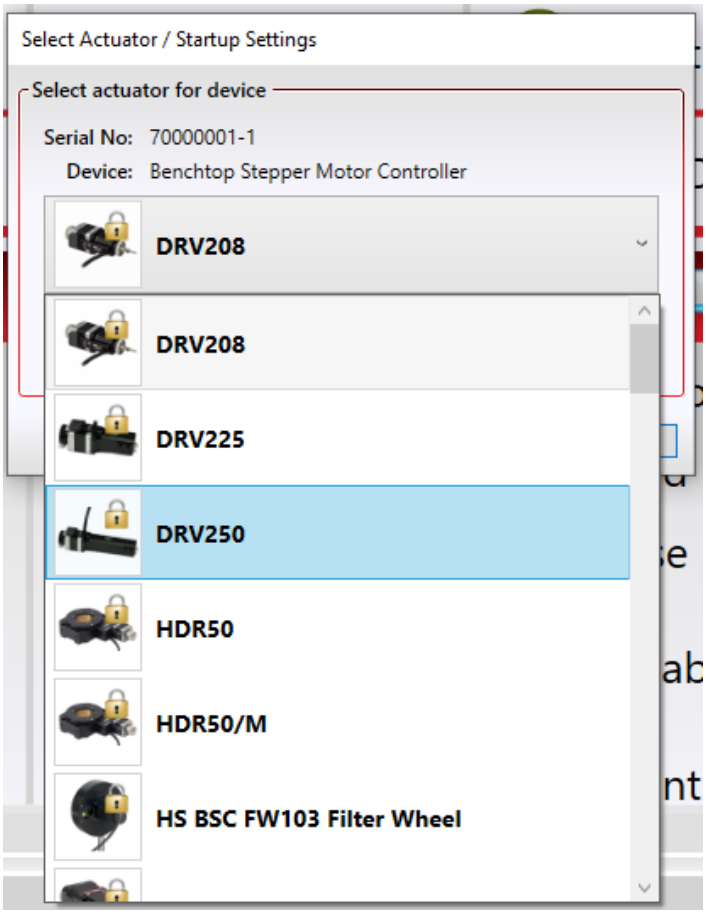


Fig. 3.3 Select Actuator Stage Settings Window - 2

6) Click OK.
7) The server reads in the stage and controller information automatically and loads default parameters set at the factory, i.e.
   Max speed 20 mm/sec
   Max acceleration 20 mm/sec/sec
   Home switch Forward.
   Refer to the handbook for the associated controller for more information on driving the actuator.

3.4 Maintenance

Note

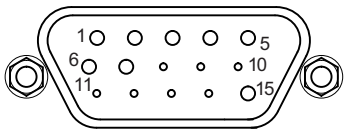
No customer serviceable parts. Return to manufacturer for service.

After prolonged use, and particularly in applications where small movements are continually repeated, the grease on the drive shaft may build up. This may cause rough or noisy movement, vibration and excessive heating.

It is good practice to run the motor periodically from one end of travel to the other several times in order to redistribute the grease.

3.5 Pin Assignments

Pin assignments for the male D-Type connector on the motor flying lead are described below..



Pin	Description	Pin	Description
1	Limit Ground [a]	**9**	EEPROM
2	CCW Limit Switch	**10**	+5 V
3	CW Limit Switch	**11**	Reserved for Future Use
4	Motor Phase B -	**12**	Reserved for Future Use
5	Motor Phase B +	**13**	+ 5 V
6	Motor Phase A -	**14**	Reserved for Future Use
7	Motor Phase A +	**15**	Ground
8	Reserved for Future Use		

Note a. The limit switch ground wire is connected to the motor body.

Fig. 3.4 Output Connector

Note

The Electrically Erasable Programmable Read-only Memory (EEPROM) helps in recognizing the device after connecting to the software.

3.6 Extension Cables

The motor is supplied with 1 m flying lead. Additional extension cables are available separately.

Chapter 4 Specifications

4.1 Specifications

Specification	DRV225	DRV250
Travel Range	25 mm	50 mm
Unidirectional Repeatability	±1.6 µm	
Bidirectional Repeatability	±3.9 µm	
Maximum Pushing Force [a]	180 N	
Max Velocity	50 mm/s	
Max Acceleration	50 mm/s^2	
Limit Switches	Hall Effect	
Homing Repeatability	±3.6 µm	
Feedback	None [b]	
Motor Type	2-Phase Stepper Motor	
Full Step Angle	1.8°	
Lead Screw Pitch	1.0 mm	
Microsteps per Revolution	409,600	
Motor Phase	2	
Rated Voltage	4.6 V	
Rated Current per Phase	0.85 A	
Resistance per Phase	3.6 Ohms	
Inductance / Phase	4.6 mH	
Holding Torque	0.2 N•m	
Rotor Inertia	24 x 10^{-7} kg•m^2	
Insulation	Class B	
Operating Temperature Range	5 to 40 °C	
Humidity Range	Less than 80% RH (Non-Condensing) at 31 °C	
Actuator Mass	0.63 kg	0.71 kg
Cable Length	1.0 m	
Connector Type	D-sub DE 15 Pin Male	
Compatible Controllers	BSC201, BSC202, BSC203, MST602	

a. The unit requires a pre-load in order to function properly and should be used only for pushing loads, do not use for pulling.

b. Although feedback is not provided within the actuator, closed loop control can be achieved by using the LNR50SE stage.

4.2 How to Calculate the Linear Displacement

The DRV series motors have 200 full steps per revolution and when driven by the BSC20x or MST602 drivers there are 2048 microsteps per full step, giving 409,600 microsteps per revolution of the motor lead screw. The lead screw pitch is 1.0 mm

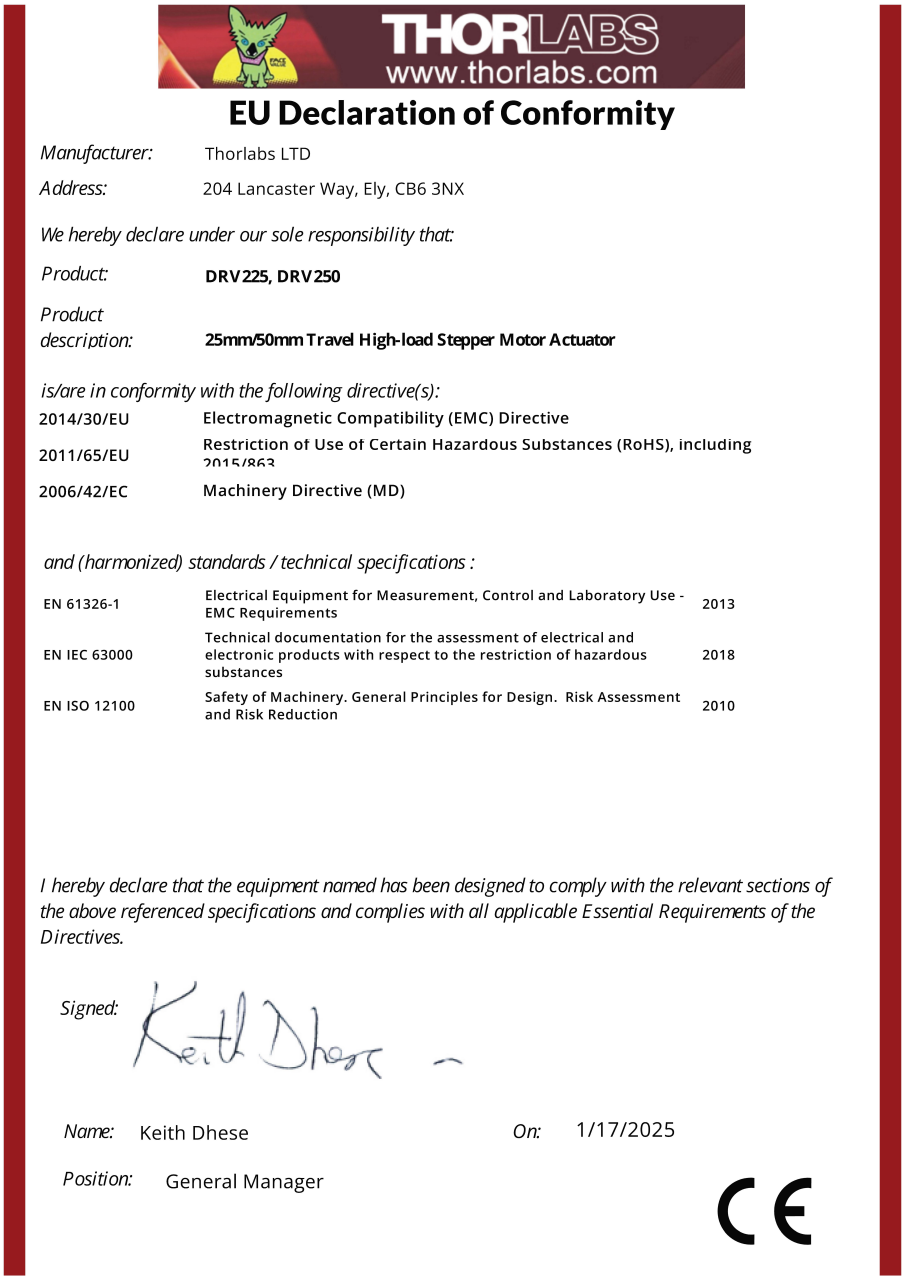
The linear displacement of the lead screw per microstep:

1 / 409600 = 2.4 x 10^{-6} mm

Chapter 5 Regulatory

5.1 Declarations Of Conformity

5.1.1 For Customers in Europe



THORLABS
www.thorlabs.com

EU Declaration of Conformity

Manufacturer: Thorlabs LTD

Address: 204 Lancaster Way, Ely, CB6 3NX

We hereby declare under our sole responsibility that:

Product: **DRV225, DRV250**

Product description: **25mm/50mm Travel High-load Stepper Motor Actuator**

is/are in conformity with the following directive(s):

2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS), including 2015/863
2006/42/EC	Machinery Directive (MD)

and (harmonized) standards / technical specifications :

EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	2018
EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010

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

Name: Keith Dhese *On:* 1/17/2025

Position: General Manager

CE

5.1.2 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 6 Thorlabs Worldwide Contacts

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



Corporate Headquarters
Thorlabs, Inc.
43 Sparta Ave
Newton, New Jersey 07860
United States

sales@thorlabs.com
techsupport@thorlabs.com

EU Importer
Thorlabs GmbH
Münchner Weg 1
D-85232 Bergkirchen
Germany

sales.de@thorlabs.com
europe@thorlabs.com

Product Manufacturer

Thorlabs Ltd.
204 Lancaster Way Business Park
ELY CB63NX
UNNITED KINGDOM
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

UK Importer
Thorlabs Ltd.

204 Lancaster Way Business Park
Ely CB6 3NX
United Kingdom

sales.uk@thorlabs.com
techsupport.uk@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