



# DRV013 and DRV014 Stepper Motor Actuators

## User Guide



Original Instructions

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# Chapter 1 Overview

## 1.1 Description

These motor actuators offer 1" (25 mm) and 2" (50 mm) of travel and better than 1  $\mu$ m of bidirectional repeatability. When used with one of our stepper motor controllers, such as the BSC201, this actuator can achieve better than 50 nm resolution and a default maximum speed of 20 mm/s.

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 1.8° step size, which produces mechanical noise, to be reduced to much smaller steps with inherently lower resultant vibrational noise.

The Stepper Motor drive has been equipped with a trapezoidal screw thread for a cleaner, more wear resistant operation than is available from a standard threading.

The actuator uses a stepper motor that provides sufficient torque for large loads up to 48 lbs (22 kg). The use of a trapezoidal leadscrew in the DRV013 provides a number of benefits over the more common Acme-style thread. The benefits are improved durability, lower friction due to improved surface quality, and nearly no back-drive.

These actuators are compatible with our 2" TravelMax manual stages. To use the actuator with these stages, mount the motor to the side of the stage using two M4 x 40 cap screws (included).

## 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**

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.

## Chapter 3 Operation and Maintenance

### 3.1 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.

#### Using APT Software

- 1) Shut down all applications using the APT server (e.g. APT User or your own custom application).
- 2) Run the APT Config utility - Start/All Programs/Thorlabs/APT Config/APT Config.
- 3) From the 'APT Configuration Utility' window, click the 'Stage' tab.

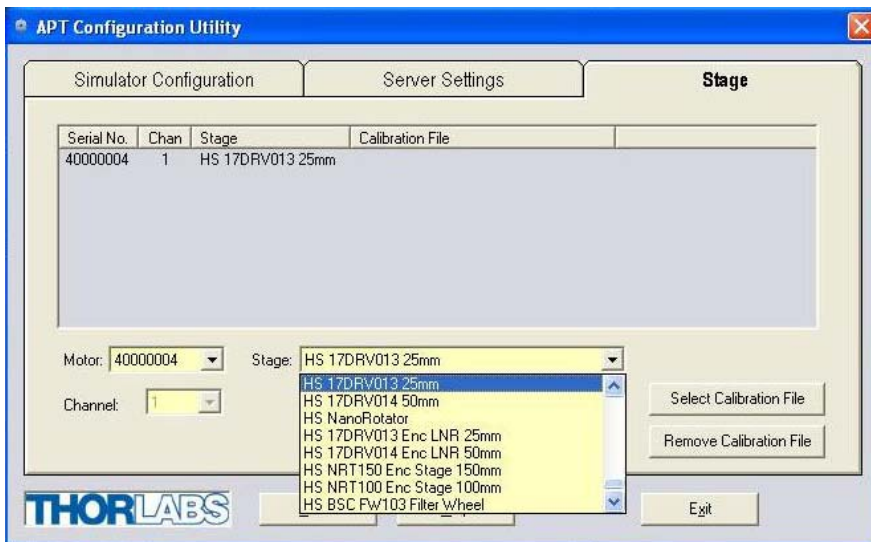


Fig. 3.1 APT Configuration Utility - Stage Tab

- 4) In the 'Motor' field, select the serial number of the stepper motor controller to be configured (this number can be found on the rear panel of the controller unit).

**Note**

To ensure correct operation, it is important to select the correct stage type for your controller. If using a BSC20x series controller, select the appropriate 'HS 17DRV' option. If using a legacy BSC0xx or BSC10x controller, choose an option without the 'HS' prefix.

Selecting an incompatible stage type could result in reduced velocity/resolution. In rare cases the actuator may be inoperable.

- 5) In the 'Stage' field, select your actuator type from the list displayed (e.g. HS 17DRV013 25mm).
- 6) Click the 'Add Stage Association' button.
- 7) A default configuration is set at the factory and stored in the non-volatile memory of the motor controller. The server reads in the stage and controller information on start up. See the handbook supplied with the stepper motor controller for further information.





## Using Kinesis Software

- 1) Ensure that the device is connected to the PC and powered up.
- 2) Run the Kinesis software - Start/All Programs/Thorlabs/Kinesis/Kinesis.
- 3) On start-up, the 'Actuator/Startup Settings ' window is displayed This window allows the correct actuator to be selected.

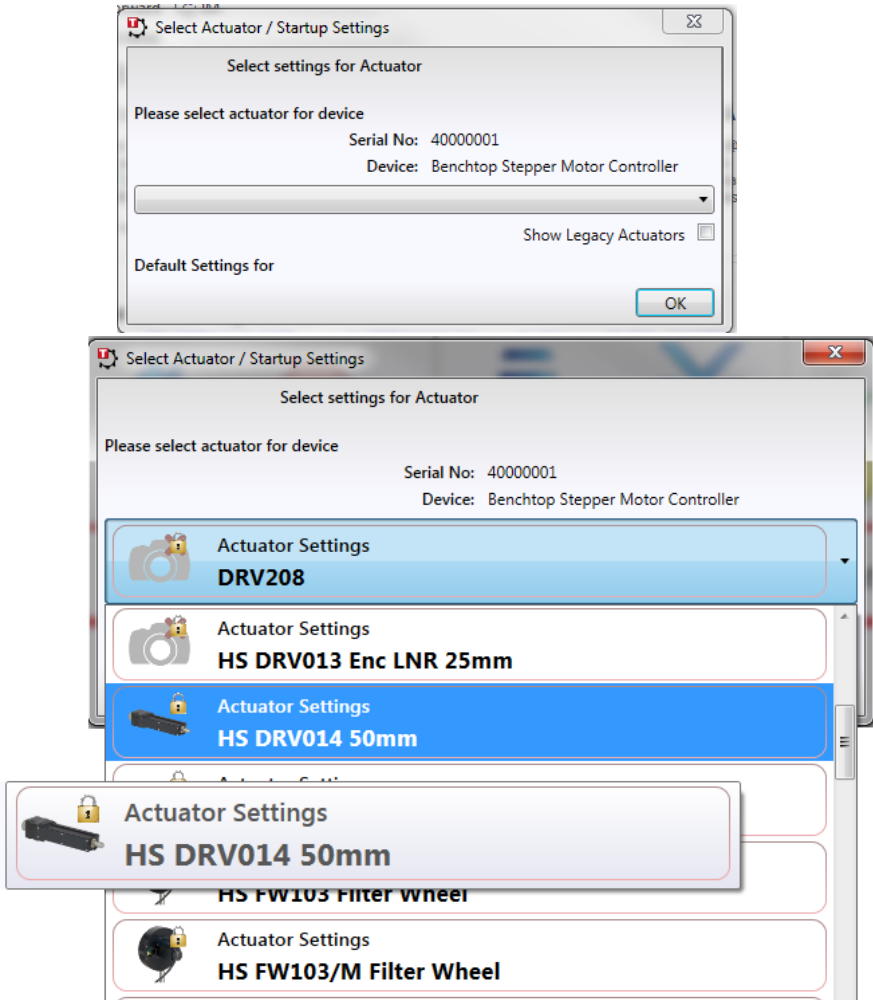


Fig. 3.1 Stage Configuration Window

- 4) Select your actuator type (e.g. HS DRV014 50 mm or HS DRV013 Enc LNR 25 mm) .
- 5) Click OK.

- 6) The server reads in the stage and controller information automatically. refer to the handbook for the associated controller for more information on driving the actuator/stage.

## **3.2 Maintenance**

### **Note**

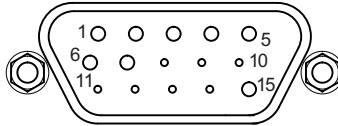
No customer serviceable parts. Return to manufacturer for service.

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 practise to run the motor periodically from one end of travel to the other several times in order to redistribute the grease.

### 3.3 Pin Assignments

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



**Fig. 3.2 Output Connector**

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

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

### 3.4 Extension Cables

The motor is supplied with a 0.5m flying lead and a 3 m (PAA613) extension cable. Additional extension cables are available separately - see [www.thorlabs.com](http://www.thorlabs.com) for more details.

## Chapter 4 Specifications

### 4.1 Specifications

Specification	DRV013	DRV014
Travel Range	25 mm	50 mm
Lead Screw	1 mm Pitch, Trapezoidal	
Bidirectional Repeatability	<1.0 $\mu$ m	
Full Step Angle	1.8°	
Microsteps per Revolution	409,600	
Step Angle Accuracy	5%	
Rated Phase Current	1 A	
Resistance/ Phase	3.6 Ohms	
Inductance / Phase	4.6 mH	
Holding Torque	23.1 N•cm	
Detent Torque	1.7 N•cm	
Rotor Inertia	32 g•cm <sup>2</sup>	
Max Load Capacity	48 lbs (22.0 kg)	
Max Speed <sup>a</sup>	20.0 mm/sec	
Min. Incremental Movement <sup>b</sup>	50.0 nm	
Motor Type	2 Phase Stepper	
Insulation Class	B	
Limit Switches	Ceramic Tipped, Electro-Mechanical, Normally Closed	
Weight	1.8 lbs (0.8 kg)	
Compatible Controllers	BSC201, BSC202, BSC203, MST602	

a. This is the maximum speed set by default when used with one of our stepper motor controllers. By adjusting settings on the controller, the maximum speed may be set to as high as 50 mm/s.

b. Valid if used with one of our stepper motor controllers.

### 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:

$$1 / 409600 = 2.4 \times 10^{-6} \text{ mm}$$

## Chapter 5 Regulatory

### 5.1 Declarations Of Conformity


#### 5.1.1 For Customers in Europe

See Section 5.2.

#### 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.

## 5.2 CE Certificate



# THORLABS

www.thorlabs.com

### *EU Declaration of Conformity*

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

We Thorlabs Ltd.  
Of 1 Saint Thomas Place, Ely, Cambridgeshire, CB7 4EX

*in accordance with the following Directive(s):*

2006/42/EC	Machinery Directive (MD)
2004/108/EC	Electromagnetic Compatibility (EMC)
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

*hereby declare that:*

Model: **DRV013 & DRV014**  
Equipment: **25mm & 50mm Trapezoidal Stepper Motor Drive**

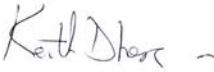
*is in conformity with the applicable requirements of the following documents:*

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010
EN61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

*and which 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:*


A 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: 

On: 13 May 2014

Name: Keith Dhese  
Position: General Manager

  
EDC - DRV013 & DRV014 -2014-05-13

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# Chapter 6 Thorlabs Worldwide Contacts

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



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## Japan

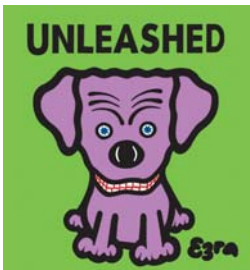
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## China

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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 disassembled 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.





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