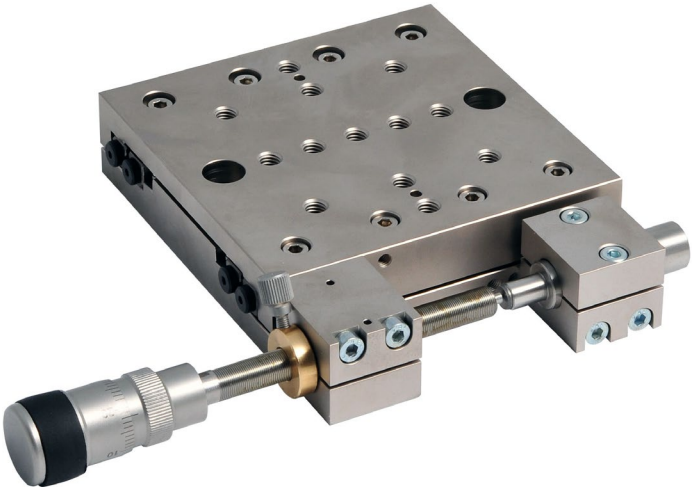
THORLABS

LNR50 Series

Linear Long-Travel Steel Translation Stage

User Guide



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Chapter 1 Safety

1.1 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.

Shock Warning

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.

1.2 General Warnings

Warnings

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Do not operate the instrument outside its rated supply voltages or environmental range. Excessive moisture may impair safety.

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 2 Getting Started

2.1 Linear Long-Travel Translation Stage

The LNR50 single-axis linear long travel stage has an all-steel construction (EN8/ AISI 1040) with heavy-duty crossed roller bearings for high-precision, high-load positioning requirements. Two versions with manual actuators are available as standard, either with micrometers (version M), or with differential drives for higher-resolution positioning needs (version DD). These can be replaced with high-precision motorized actuators, including stepper or piezo drives. If a ready-assembled stage-with-stepper drive is required, this is available with or without optical encoder, as parts LNR502E and LNR502, respectively. If a piezo drive is retrospectively fitted, the stage is compatible with the Thorlabs NanoTrak™ auto alignment module, allowing automated or semi-automated optical alignment systems to be constructed around customer specific applications

Stages can be bolted together in and XY, XZ or XYZ configurations for applications where movement is required in more than one axis – see Figure 2.1 for an example.

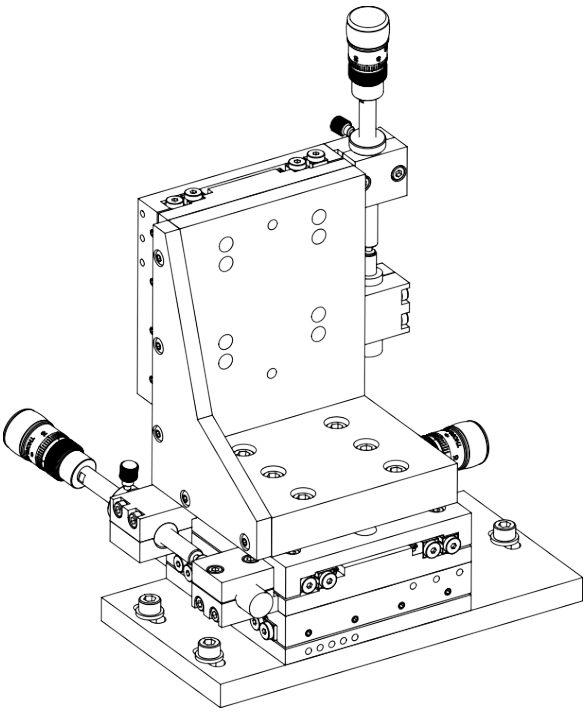


Fig. 2.1 LNR50 series linear long travel stage – typical XYZ configuration

2.1.1 Drives

Stages are supplied pre-configured with either micrometer or differential drives. If a stepper motorized version is required, please refer to the ready-assembled products LNR502 and LNR502E. However, separate motor drives are available for retrospective fitting – see Table 2.1, Fig. 2.2, and Section 2.1.2.

Note

The DRV225 and DRV250 trapezoidal stepper motor drives must be used in conjunction with the BSCxxx or MSTxxx series stepper motor controllers.

Table 2.1 Drive Options

Drives Type	Travel (mm)	Resolution (µm)	Product Number
Trapezoidal stepper motor	25.0	0.05	DRV225
Trapezoidal stepper motor	50.0	0.05	DRV250

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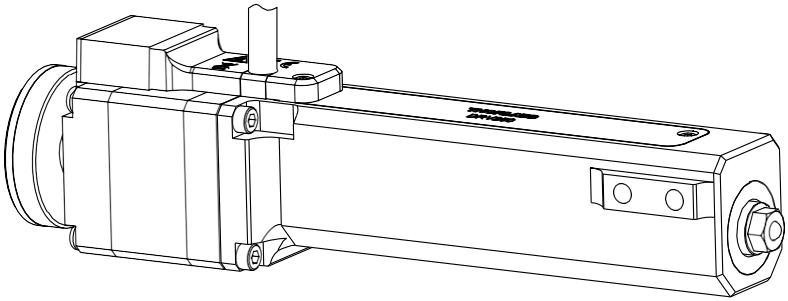


Fig. 2.2 DRV250 stepper motor drive

2.1.2 Piezo Actuators

Piezoelectric actuators have been developed for optical and fiber-optical applications, to provide linear motions up to 40 µm – see Table 2.2 and Fig. 2.3.

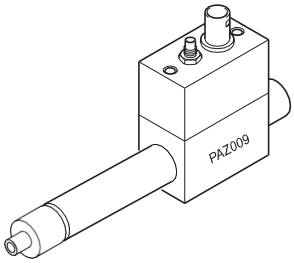


Fig. 2.3 A typical piezo actuator

Table 2.2 Piezo Actuator Options

Extension (µm at 75V dc, zero load)	Standard actuator	Feedback actuator
40	PAS009	PAZ009

Note

The piezo actuators are supplied with a PAA001 flat tip. Other tips are available separately as shown below.

Table 2.3 Piezo Tip Options

End Type	Thread	Product Number
Flat end	–	PAA001
Drive ball end	–	PAA005
Threaded	M4	PAA007
Threaded	8 - 32 UNC	PAA013

Chapter 3 Operation

3.1 Manual Differential Drives and Micrometer Drives

3.1.1 Adjusting Differential Drives

Unlike standard micrometers, Differential Drives contain a double spindle that can be used to increase the measurement resolution. The coarse adjustment works with a leadscrew of pitch 0.5 mm, allowing translation across the whole actuator range (in this case, 50.8 mm) at 0.5 mm per revolution. Where the finer adjustment is required, the coarse adjuster is locked (via the Locking Screw – see Figure 3.1) and the Fine Adjuster knob allows the second spindle to be used to provide an effective 50 µm of motion per revolution, but over a shorter travel range of 300 µm.

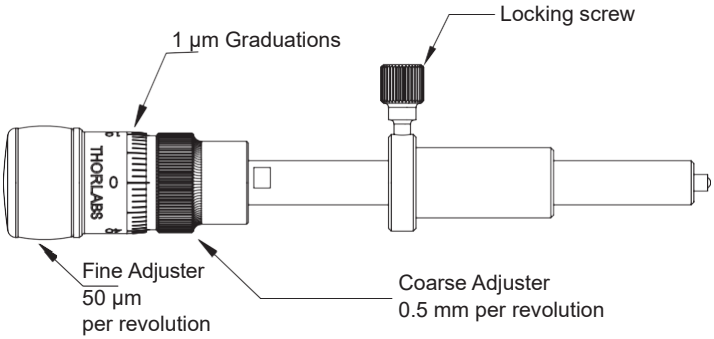


Fig. 3.1 Adjusting a differential drive

3.2 Motor Drives

To ensure that a particular stage is driven properly by the system, several 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.).

For information on connecting and operating your motor with the correct software package and settings, please refer to the product manual and software manual specific to your motor. Details on fitting and operating the stage with a DRV225 or DRV250 actuator can be found in the corresponding product and software manuals available at www.thorlabs.com.

3.3 Piezo Actuators

Piezo actuators are used to give nanometric positioning of the platform over a range of 40 microns – see Table 2.2. They can also modulate the position of the platform at high frequency.

On a piezo-actuated stage, position feedback may be incorporated to enhance the repeatability and linearity of piezo motion.

The piezo-actuated stage should be used together with one of the Thorlabs piezoelectric controllers – see the handbook supplied with the relevant piezoelectric controller for more information.

Chapter 4 Installation

4.1 Unpacking

Note

Retain the packing in which the unit was shipped, for use in future transportation.

Caution

Once removed from its packaging, the stage is easily damaged by mishandling.

The stage is shipped with a plate fitted to the side, which locks the carriage during transit. These plates should be removed before the stage is used. Retain the plates for future use.

4.2 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 - 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 must not be used in an explosive environment.

4.3 Mounting

4.3.1 General

The LNR50 series stages can be mounted directly to the work surface as shown in Section 4.3.2. For additional versatility, a base plate and angle bracket are available for use in horizontal or vertical mounting configurations - see Section 4.3.3. to Section 4.3.5. When mounting the stage close to other equipment, ensure that the travel of the moving platform is not obstructed. If equipment mounted on the movingplatform is driven against a solid object, damage to the internal mechanism could occur.

The range of travel on each axis is 50.8 (2”) mm total, that is ± 25 mm about the nominal position.

The stage is shipped with the drives configured for right-handed use, however they can be repositioned for applications where left handed use is more convenient - see Section 4.5. for more details.

Caution

When mounting components, or fitting the stage within an application, do not apply excessive pressure to the moving platform as this may damage the bearing mechanism.

Note

The LNR series stages can quickly be assembled into XY, XZ, YZ and XYZ configurations - see Section 4.3.4. and Section 4.3.5. The brackets and plates are supplied complete with dowels, which ensure an accurate, orthogonal assembly.

4.3.2 Mounting Directly to the Work Surface

Referring to Fig. 4.1, proceed as follows:

1) Adjust the actuator to position the moving carriage central in its range of travel and ensure that the mounting holes in the base are clearly visible through the holes in the top plate.
2) Fit two bolts (M6 x 1.0 x 10.0 mm or 1/4-20 x 3/8", not supplied) through the holes in the top platform and tighten to secure the stage to the work surface.

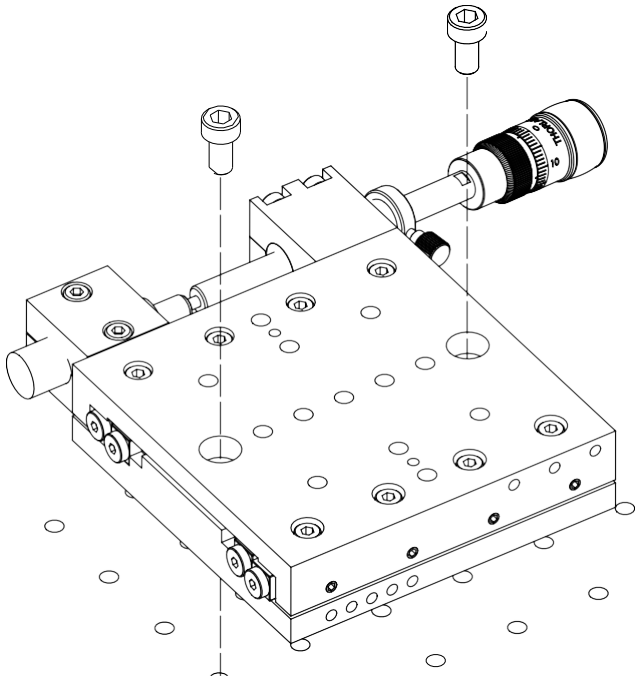


Fig. 4.1 Bolting the stage to the work surface

4.3.3 Fitting and Removing the Base Plate

Referring to Fig. 4.2, proceed as follows:

1) Adjust the actuator to position the moving carriage central in its range of travel and ensure that the mounting holes in the base are clearly visible through the holes in the top plate.
2) Fit the dowels supplied to the base plate (LNR50P1).
3) Position the stage on the base plate, ensuring that the dowels locate correctly in the holes in the lower surface of the stage.
4) Fit two bolts (M6 x 1.0 x 12.0 mm or 1/4-20 x 1/2", not supplied) through the holes in the top plate and into the base plate. Tighten to secure the stage in place.

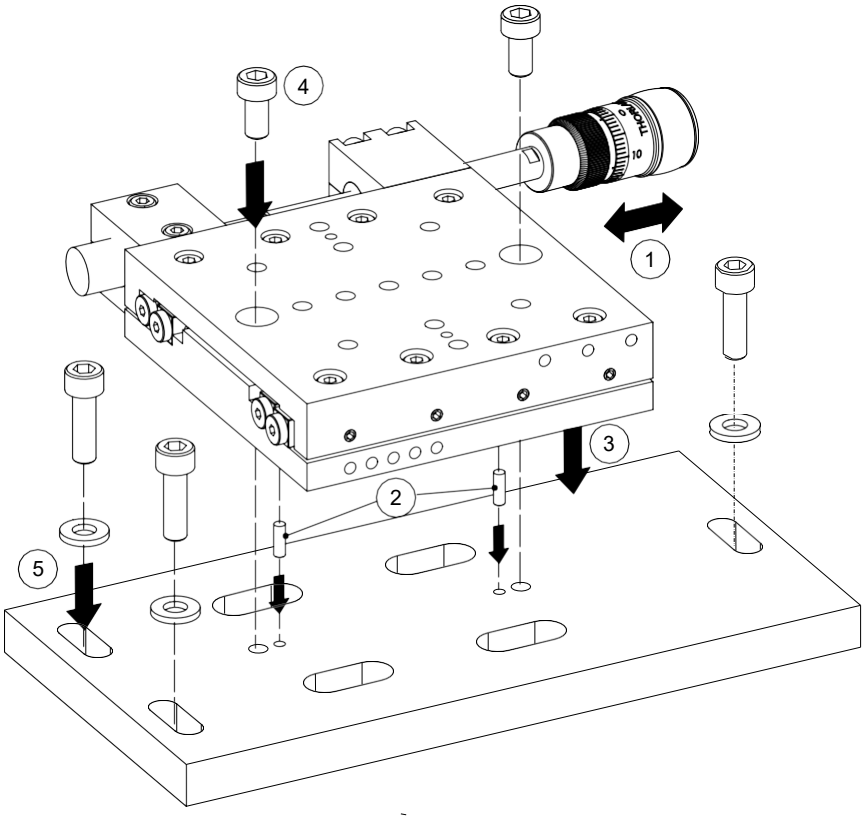


Fig. 4.2 Fitting the base plate

5) Fit three bolts (M6 or 1/4-20, not supplied) through each end of the base plate to fix the stage to the work surface.
6) To remove the base plate, reverse the procedure above.

4.3.4 Building an XY Configuration

Bolt the X-axis stage to the work surface as detailed in Section 4.3.3. then, referring to Fig. 4.3, proceed as follows:

1) Fit the dowels supplied to the moving platform of the lower stage.

Note

If the XY configuration is being constructed using stages fitted with stepper motor drives, a spacer plate (LNR50P3) will be required between the two stages before proceeding to item (2)

2) Fit the Y-axis stage into place ensuring that the dowels in the lower stage locate correctly in the holes in the lower surface of the upper stage.

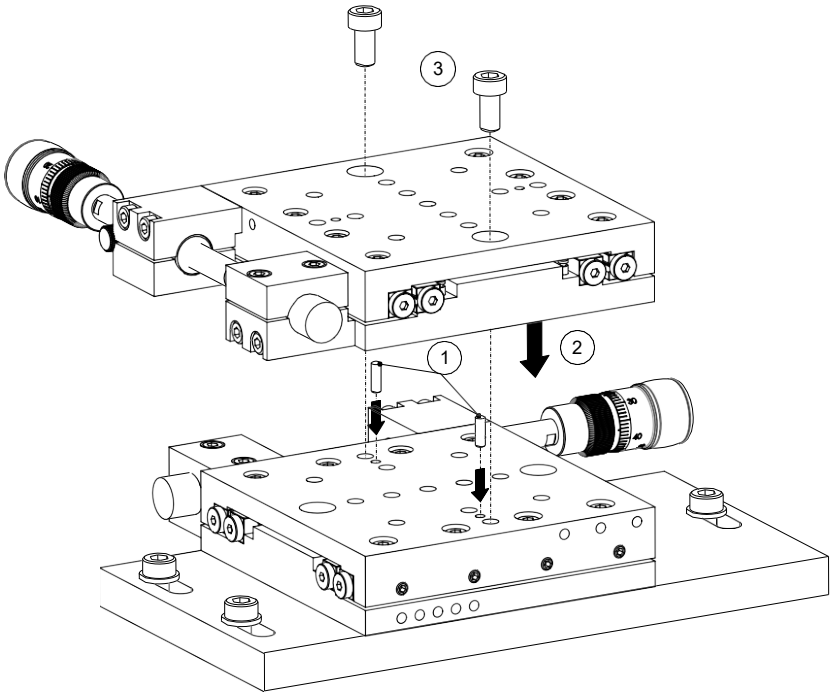


Fig. 4.3 Building an XY Configuration

3) Fit two bolts (M6 x 1.0 x 12.0 mm or 1/4-20 x 1/2", not supplied) through the holes in the upper stage and tighten to secure the stage to the moving platform of the stage beneath.

Caution

Use only bolts of the stated length. Longer bolts will protrude into the stage and damage the internal mechanism.

4.3.5 Building an XYZ Configuration

Assemble an XY configuration as detailed in Section 4.3.4. then, referring to Fig. 4.4, and Fig. 4.5 proceed as follows:

1) Fit the dowels supplied, into the moving platform on the upper stage of the XY assembly.
2) Fit the angle bracket (LNR50P2) onto the moving platform of the stage, ensuring that the dowels fitted at item (1) locate correctly in the holes on the underside of the angle bracket.

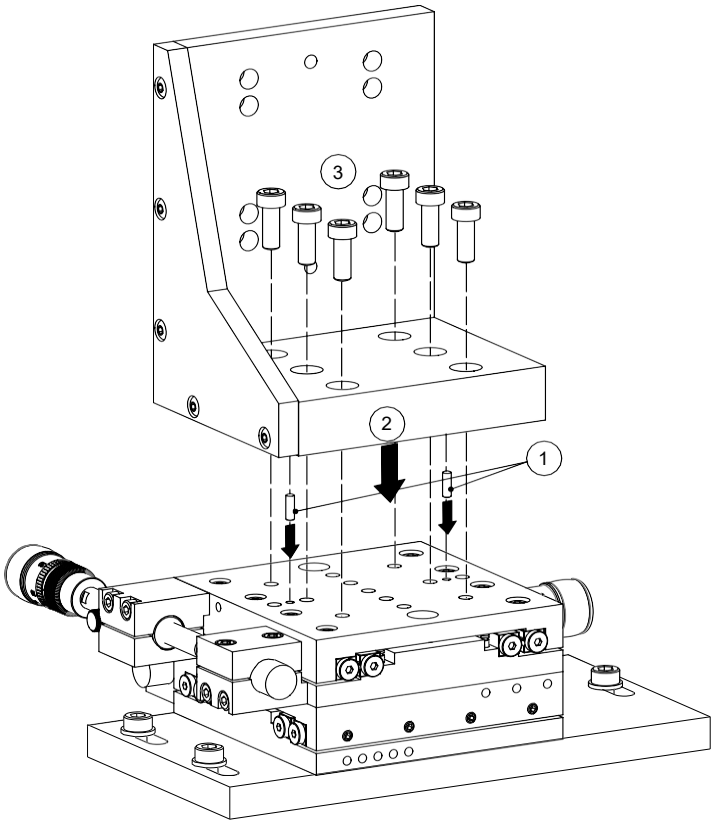


Fig. 4.4 Fitting the Angle Bracket

3) Fit six bolts (M6 x 1.0 x 16.0 mm or 1/4-20 x 5/8", not supplied), through the holes in the base of the angle bracket and tighten to secure the bracket to the XY assembly.

Caution

Use only bolts of the stated length. Longer bolts will protrude into the stage and damage the internal mechanism.

4) Fit the dowels supplied into the holes in the back surface of the angle bracket.
5) Fit the vertical-axis stage into place ensuring that the dowels fitted at item (4) locate correctly in the holes on the underside of the stage.
6) Fit two bolts (M6 x 1.0 x 12.0 mm or 1/4-20 x 1/2”, not supplied), through the holes in the topplate, and screw into the rear face of the angle bracket.

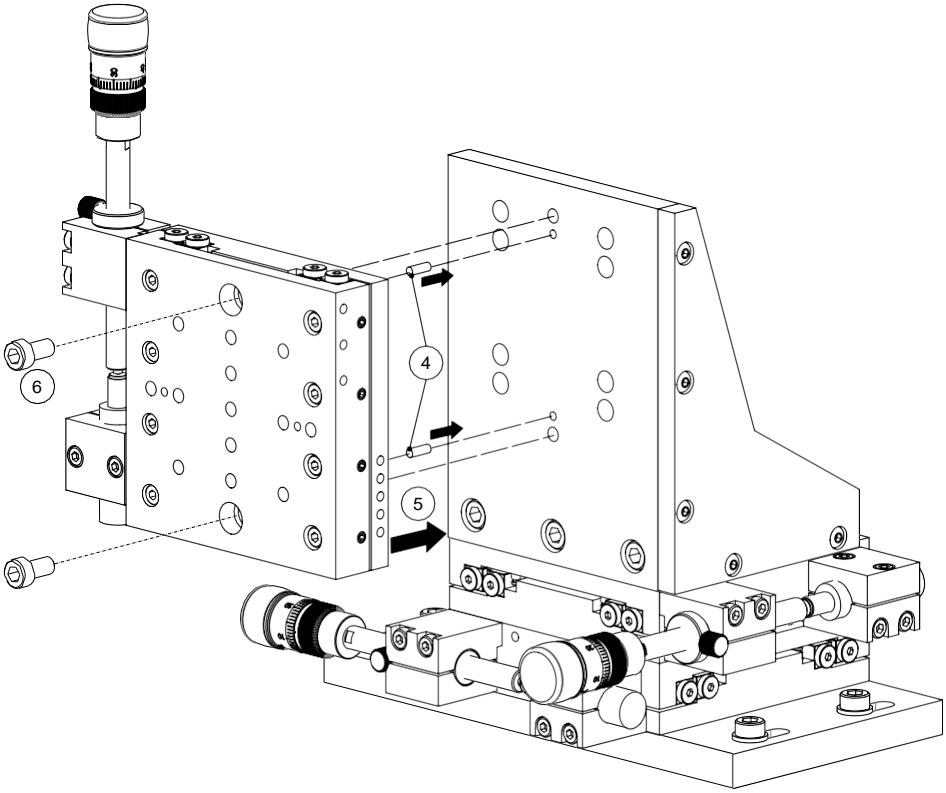


Fig. 4.5 Adding a Vertical Axis Stage

4.4 Fitting and Removal of Drives

4.4.1 Removing/Fitting a Micrometer Drive

1) Loosen the mounting block actuator pinch bolts.
2) Remove the existing drive.
3) Fit the replacement drive.
4) Tighten the mounting block pinch bolts.
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.

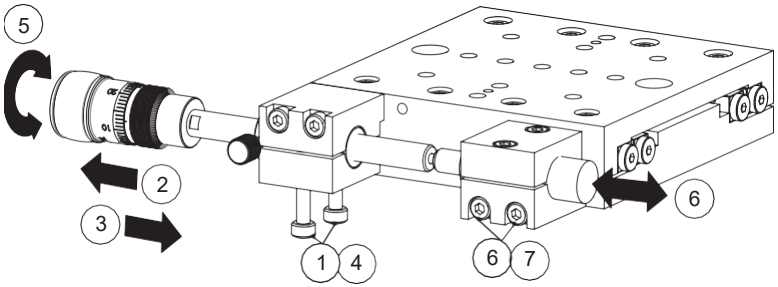


Fig. 4.6 Fitting/removing a micrometer drive

4.5 Reconfiguring the Actuator Position

The stage is shipped with the drives configured for a right-handed configuration, however they can be repositioned for left-handed use. This is achieved by swapping the position of the actuator clamp and the push block as follows:

Referring to Fig. 4.7:

1) Remove the actuator as detailed in Section 4.4.
2) Undo the mounting block attachment bolts and remove the mounting block.
3) Loosen the push block pinch bolts.
4) Remove the push block.
5) Undo the push block mounting bolts and remove the push block mounting block.

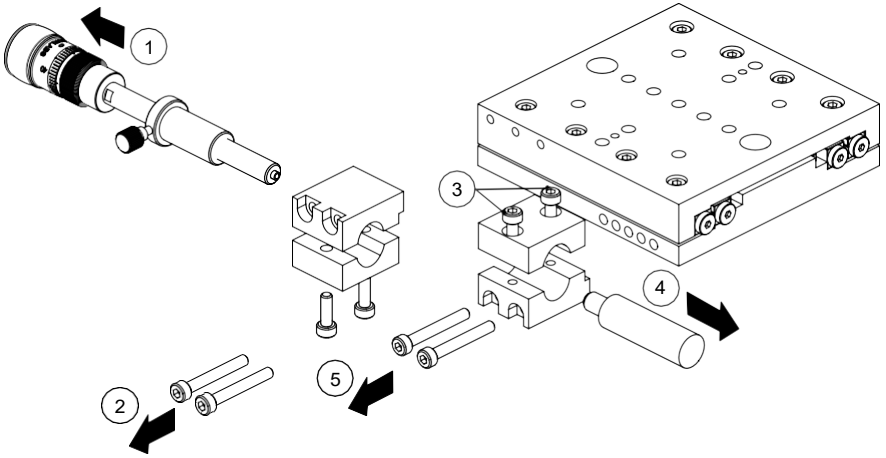


Fig. 4.7 Removing the Actuator Clamp and Push Block

Referring to Fig. 4.8:

6) Refit the push block mounting block on the opposite side of the stage as shown in Fig. 4.8 and tighten the attachment bolts.
7) Refit the push block.
8) Tighten the push block pinch bolts.
9) Refit the actuator mounting block as shown in Fig. 4.8 and tighten the attachment bolts.
10) Refit the actuator, then tighten the mounting block pinch bolts.
11) Adjust the actuator to its center position.
12) Loosen the push block pinch bolts and position the push block such that the stage is in its center of travel.
13) Tighten the push block pinch bolts.

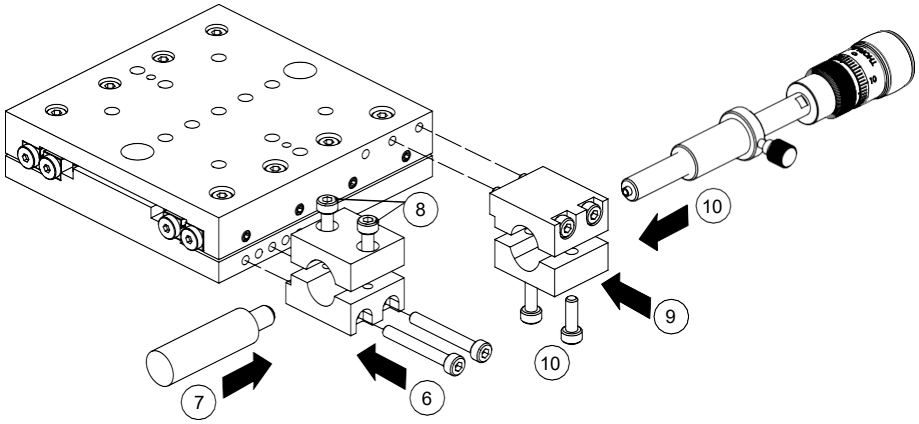


Fig. 4.8 Reconfiguring the Actuator Position

4.6 Mounting Equipment to the Stage

Caution

The weight attached to the moving platform must not exceed 10 kg.

Do not apply excessive forces to the moving platform.

Thorlabs manufacture a variety of fibre chucks, holders, and fixtures to fit the linear stage. All these accessories are mounted to the stage via a top platform.

4.7 Transportation

Caution

The drives should be removed before transporting the stage.

When packing the unit for shipping, use the original packing. If this is not available, use a strong box and surround the stage with at least 100 mm of shock absorbent material.

Chapter 5 Specifications

5.1 LNR50 with Micrometer and Differential Drives

Parameter	LNR50DD	LNR50M
Adjuster Type	Differential Drive	Micrometer
Travel	50.8 mm (2.0")	
Bearings	Crossed Roller	
Construction Material	Steel, EN8 (AISI 1040)	
Horizontal Load Capacity[a]	30 kg (66 lbs)	
Vertical Load Capacity[a]	4 kg (8.8 lbs)	
Runout[b] Over Full Range	± 5 µm	
Pitch Angular Deviation	0.03°	
Yaw Angular Deviation	0.015°	
Weight (Excluding Drives)	1.8 kg (3.96 lbs)	
Engraved Graduations	NA	10 µm
Screw Pitch	Coarse: 0.5 mm Fine: 50 µm	0.1 mm

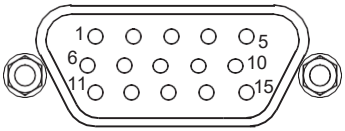
a. Partly dependent on actuator type; for heavier loads, use the stepper motor drive
b. Deviation from axis of travel

5.2 Additional Stage Specifications with DRV250 Stepper Drive

Parameter	Value
Vertical Load Capacity	10 kg (22 lbs)
Horizontal Load Capacity	48 kg (105 lbs)
Max Velocity	50 mm/s
Max Acceleration	50 mm/s^2
Minimum Achievable Incremental Movement	0.05 µm
Minimum Repeatable Incremental Movement	1 µm
Backlash	< 6 µm
Absolute On-Axis Accuracy	10 µm
Bidirectional Repeatability	±3.9 µm
Home Location Accuracy	±1.0 µm

5.3 Stepper Motor Connector Pin Out

The Motor D-Type connector provides a connection to the Stepper motor controller. The pin functions are detailed in Fig. 5.1



Pin	Description	Pin	Description
1	Ground/Return	6	Motor Phase A -
2	CCW Limit Switch	7	Motor Phase A +
3	CW Limit Switch	8 to14	Not Used
4	Motor Phase B -	15	Braid/Screen
5	Motor Phase B +		

Fig. 5.1 Stepper Motor Connector Pin Descriptions

5.4 Piezo Actuated Stage Specifications

Caution

The stage should only be used in conjunction with the appropriate Thorlabs Piezoelectric Controllers.

Maximum Input Voltage	75 V
Operating Temperature	–20 °C to 80 °C

Chapter 6 Maintenance

6.1 Preventive Maintenance

Warning

The equipment contains no user serviceable parts. There is a risk of severe 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 attempt any repairs or adjustments. Maintenance is limited to cleaning only.

Chapter 7 Regulatory

7.1 Declarations Of Conformity

7.1.1 For Customers in Europe

See Section 7.2.

7.1.2 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.

7.2 CE Certificate

E C Declaration of Conformity

We,

Thorlabs Ltd
1 Saint Thomas Place,
Cambridgeshire Business Park,
Ely, Cambridgeshire
CB7 4EX

declare that the motorized or piezo equipped travelling stages of the LNR50 series comply with the following Harmonized European Standards:

BS EN 61326-1:1998
BS EN 61000-3-2: 2000
BS EN 61000-3-3: 1995
EN 61010-1: 2001

And is in conformity with

93/68/EEC – CE Marking Directive (1996)
89/336/EEC – EMC Directive (1996)
73/23/EEC – Low Voltage Directive (1997)

Signed in **Ely** (place)

On the 11 (day) day of July (month) 2012 (year)

Name: **Keith Dhese**

Position: **General Manager**

Chapter 8 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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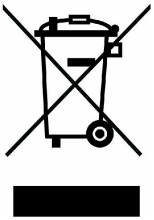
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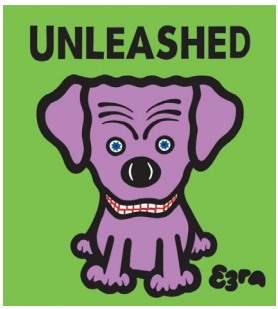
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Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical 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 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.





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