THORLABS

LNR25 Series
25 mm Translation Stage

User Guide

Original Instructions

Contents

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. 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.

Chapter 2 Overview

2.1 Introduction

The LNR25 series stages offer stability, and high load capacity, making them an ideal solution for all translation applications. Designed with the highest quality linear rails available, the performance is further enhanced by using thermally matched materials that ensure its stability. The rigidity of the all-steel construction, along with the heavy-duty cross-roller bearings, provides uniform performance over the entire range of motion.

The stages in the series are fitted with a variety of mechanical and motorized actuators:

Standard micrometers: The LNR25M and LNR25M/M are imperial and metric versions of the stage, fitted with our standard 1" (25 mm) micrometers (150-801ME or 150-811ST). These deliver 0.025" (0.5 mm) translation per revolution over the 1" (25 mm) travel range and have 0.001" (10 µm) graduation marks.

Differential micrometers: For applications that require increased resolution, the LNR25D and LNR25D/M models are fitted with a DM12 differential actuator. The coarse adjustment of this provides 500 µm translation per revolution over the full 25 mm (1") travel range. The coarse adjustment can be locked using a thumbscrew located on the mounting collar, whereupon a differential adjustment mechanism provides 25 µm (0.001") of translation per revolution, over a 250 µm (0.01") range. The differential adjustment knob features a vernier with 0.5 µm graduations.

Stepper motor drives: The LNR25ZFS is fitted with our ZFS25B 25 mm (0.98") compact stepper motor actuator. The actuators allow very small step sizes over the entire travel range, delivering greater flexibility with negligible backlash and fine resolution. The design incorporates a 44:1 gear reduction head which, when combined with the 49,152 microsteps per revolution offered by the KST101 stepper motor driver gives a theoretical travel per microstep of 0.46 nm. The stepper motor allows for continuously variable speeds and the actuators use integrated hard stops that automatically cut the power when they have reached their mechanical limits.

All stages can be bolted together in an XY or XYZ configuration for applications where movement is required in more than one axis.

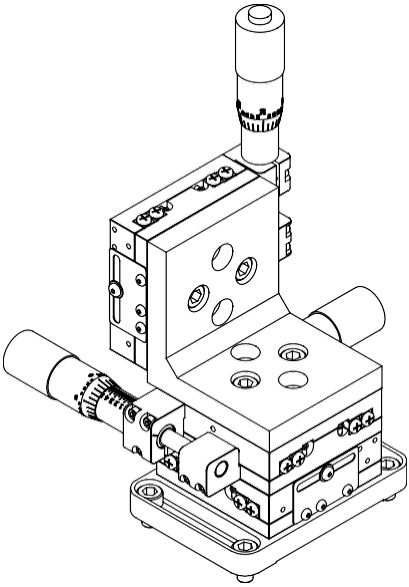

Fig. 2.1 LNR25 series linear long travel stage – typical XYZ configuration

2.1.1 Drives

Stages are supplied pre-configured with either manual or motor drives. However, various motorized and manual drives are available, which can easily be fitted later as the application needs change – see Table 2.1 below.

Note

Motor drives must be used in conjunction with the recommended motor controller - see www.thorlabs.com for more details.

Table 2.1 Drive Options

Drives Type	Travel (mm)	Product Number	Controller
Stepper Motor Drive	25.0	ZST225B	KST101
Compact Stepper Motor Drive	25.0	ZFS25B	KST101
Imperial Micrometer Drive	25.0	150-811ST	-
Metric Micrometer Drive	25.0	150-801ME	-
Differential Drive	25.0	DM12	-

Chapter 3 Installation

3.1 Unpacking

Notes

During handling or shipping, the moving platform must be constrained to avoid damage to the bearings.

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

The following sections include examples which show the fitting and removal of micrometer drives. The process for fitting/removing motorized drives is the same.

Caution

The stage is shipped with a plate fitted to the side, which locks the carriage during transit and in applications where accidental adjustment is undesirable. The locking screw on these plates must be loosened before the stage is used - see Section 3.2.6.

3.2 Mounting

3.2.1 General

The LNR25 series stages can be mounted directly to the work surface as shown in Section 3.2.2. For additional versatility, a base plate and angle bracket are available for use in horizontal or vertical mounting configurations - see Section 3.2.3. to Section 3.2.5.

Warning

If the stage is mounted close to solid objects, items can become trapped when the stage is operated, particularly if motor actuators are fitted.

Care must be taken to keep fingers away from any moving parts if the stage is mounted closer than 25 mm (1.0”).

Caution

When mounting the stage close to equipment, ensure that the travel of the moving platform is not obstructed. If equipment mounted on the moving platform is driven against a solid object, damage to the internal mechanism could occur. The range of travel on each axis is 25 mm total, that is ± 12.5 mm about the central position.

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.

The stage is shipped in standard configuration, but the drives can be repositioned for applications where space is limited - see Section 3.4. for more details.

Note

The LNR series stages can quickly be assembled into XY, XZ, YZ and XYZ configurations - see Section 3.2.4. and Section 3.2.5. The brackets and plates are supplied complete with all bolts and dowels, which ensure an accurate, orthogonal assembly.

3.2.2 Mounting Directly to the Work Surface

Referring to Fig. 3.1, 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 10 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.

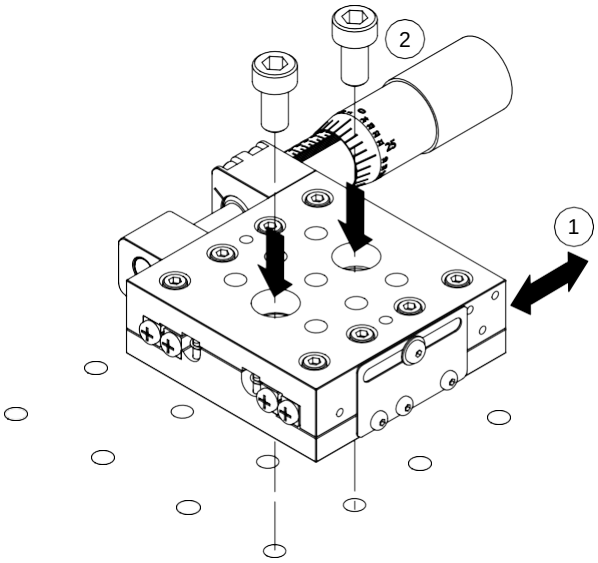

Fig. 3.1 Bolting the stage to the work surface

3.2.3 Fitting and Removing the Base Plate

Referring to Fig. 3.2, proceed as follows:

1) Fit the dowels supplied to the base plate (LNR25P1).
2) Position the stage on the base plate, ensuring that the dowels locate correctly in the holes in the lower surface of the stage.
3) Fit two bolts supplied (M6 x 8 or 1/4-20 x 5/16") through the holes in the underside of the base plate, and tighten to secure the stage in place.

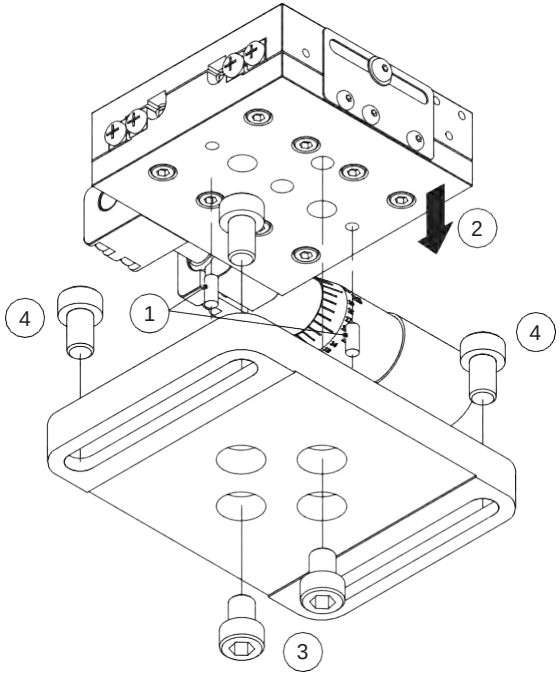

Fig. 3.2 Fitting the base plate

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

3.2.4 Building an XY Configuration

Bolt the X-axis stage to the work surface as detailed in Section 3.2.3. then, referring to Fig. 3.3, proceed as follows:

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

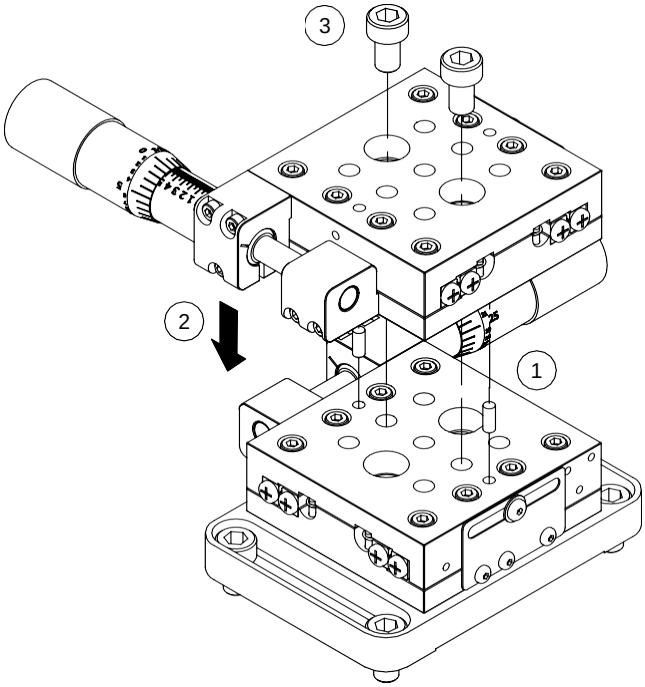

Fig. 3.3 Building an XY Configuration

3) Fit two bolts (M6 x 10 or 1/4-20 x 3/8", 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.

3.2.5 Building an XYZ Configuration

Assemble an XY configuration as detailed in Section 3.2.4. then, referring to Fig. 3.4, and Fig. 3.5 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 (LNR25P2) 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.

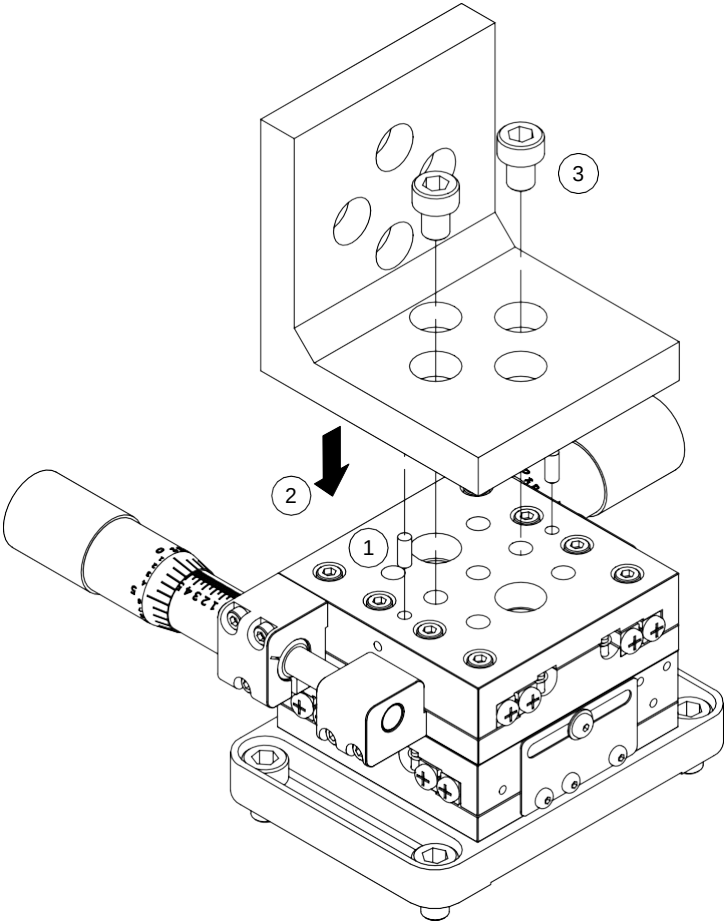

Fig. 3.4 Fitting the Angle Bracket

3) Fit the two bolts supplied (M6 x 8 or 1/4-20 x 5/16”), through the holes in the base of the angle bracket, and tighten to secure the bracket to the XY assembly.

4) Fit the dowels supplied to the underside of the base on the vertical-axis stage.
5) Fit the vertical-axis stage into place ensuring that the dowels fitted at item (4) locate correctly into the holes in the back surface of the angle bracket.
6) Fit the two bolts supplied (M6 x 8 or 1/4-20 x 5/16”), through the holes in the angle bracket, and screw into the base of the vertical-axis stage.

Caution

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

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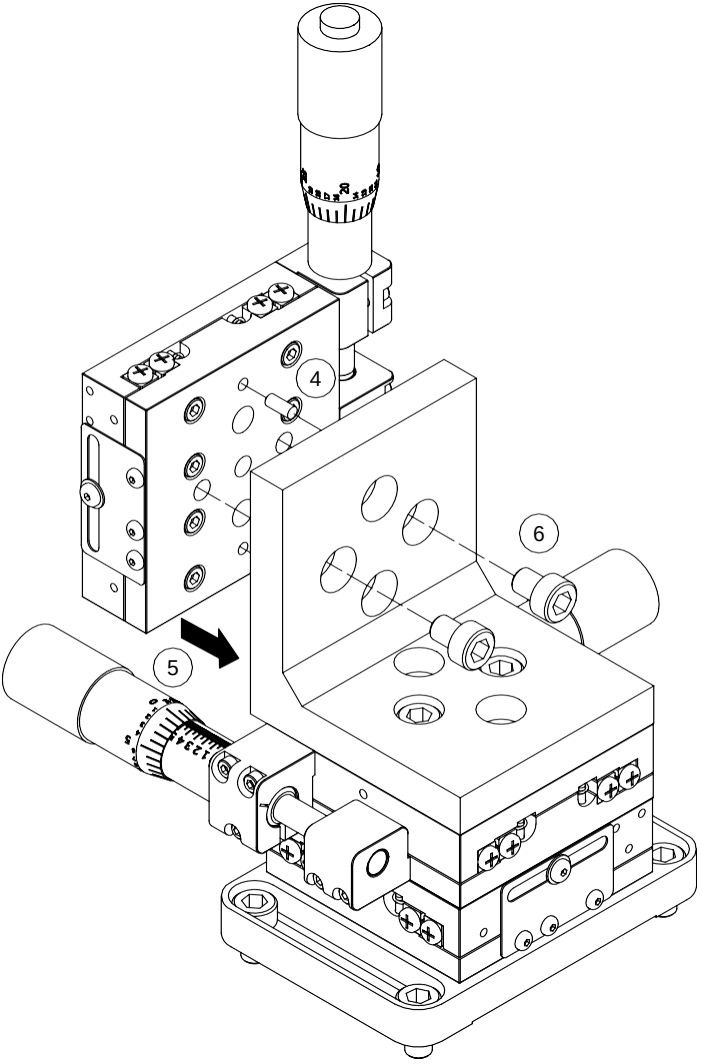


Fig. 3.5 Adding a Vertical Axis Stage

3.2.6 Locking Mechanism

The stage is shipped with a plate fitted to the side, which locks the carriage during transit, and in applications where accidental adjustment is undesirable. The locking screw on these plates should be loosened before the stage is used as shown in Fig. 3.6.

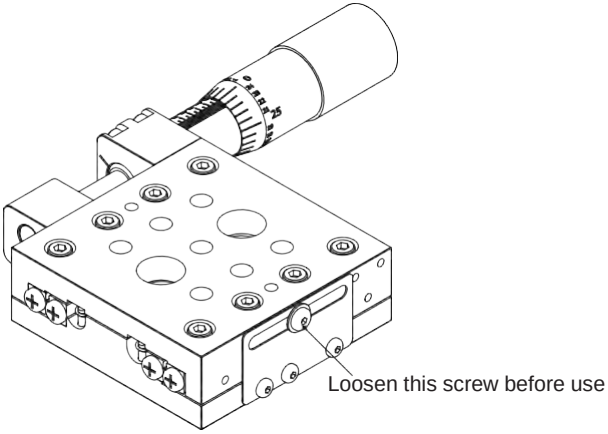


Fig. 3.6 Loosening the Locking Screw

3.3 Fitting and Removal of Drives

The stages are shipped with the actuators already fitted. If a drive needs to be replaced, refer to Fig. 3.7 and proceed as follows:

1) Ensure that the carriage is locked by tightening the locking screw.
2) Loosen the mounting block actuator pinch bolt.
3) Remove the existing drive.
4) Fit the replacement drive.
5) Tighten the mounting block pinch bolt.
6) Adjust the drive to position the actuator rod against the push block.
7) Loosen the carriage locking screw.

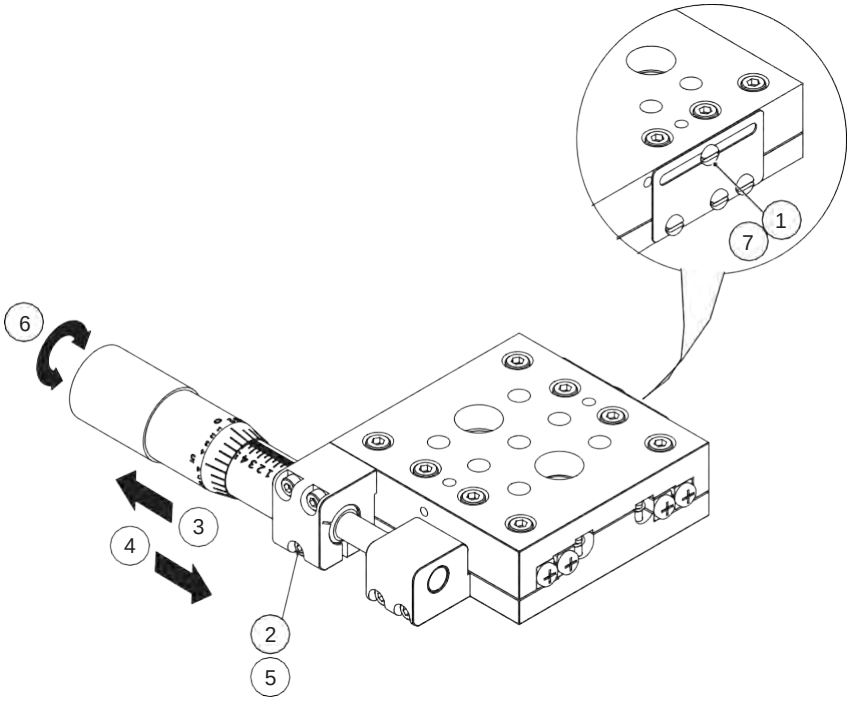


Fig. 3.7 Fitting/removing a drive

3.4 Reconfiguring the Actuator Position

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

Referring to Fig. 3.8:

1) Remove the actuator as detailed in Section 3.3.
2) Undo the mounting block attachment bolts and remove the mounting block.
3) Undo the push block attachment bolts and remove the push block.

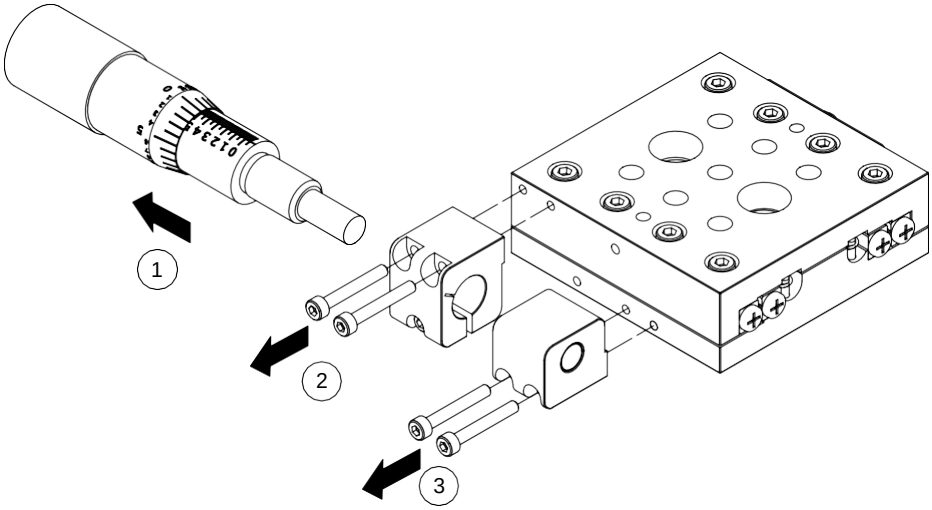


Fig. 3.8 Removing the Actuator Clamp and Push Block

Notes

During items (4) and (5) the blocks can be fitted to either side of the stage, for left- or right-handed configuration. For clarity, Fig. 3.9 shows the blocks being fitted to the same side from which they were removed. If they are to be fitted to the opposite side of the stage, the locking plate will also need to be removed.

Referring to Fig. 3.9 on the next page:

4) Refit the push block in the alternative position as shown in Fig. 3.9 and tighten the attachment bolts.

5) Refit the mounting block in the alternative position as shown in Fig. 3.9 and tighten the attachment bolts.
6) Refit the actuator, then tighten the mounting block pinch bolts.
7) Adjust the drive to position the actuator rod against the push block.
8) Loosen the carriage locking screw.

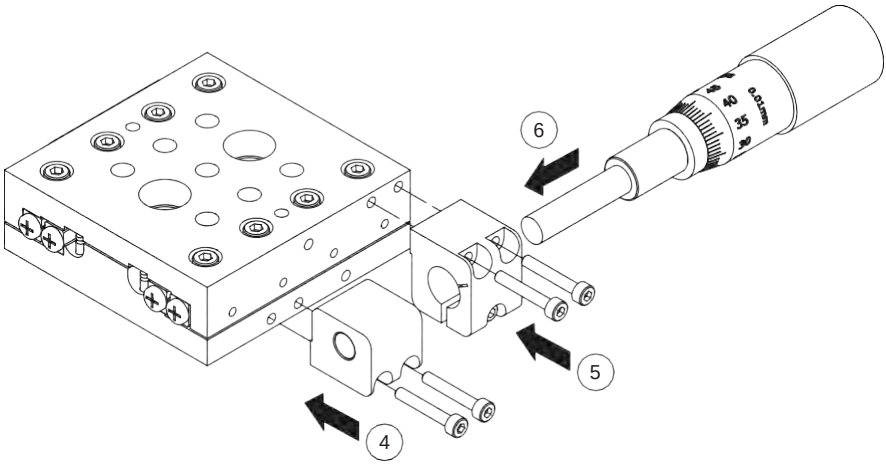


Fig. 3.9 Reconfiguring the Actuator Position

3.5 Mounting Equipment to the Stage

Caution

The load attached to a moving platform must be limited to its capacity: this is partly dependent on the actuator type being used.

For the LNR25ZFS(/M) stages:
Do not exceed 5 kg (11 lbs) if the stage is mounted horizontally, or 0.5 kg (1.1 lbs) if mounted vertically.

For the LNR25M(/M) and LNR25D(/M) stages:
Do not exceed 20 kg (44 lbs) if the stage is mounted horizontally, or 8 kg (17.6 lbs) if mounted vertically.

Do not apply excessive forces to the moving platform.

The top platform of the stage features an array of mounting holes for fitting accessories such as fiber clamps, mirror mounts etc. - see Fig. 3.10.

3.6 Transportation

Caution

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

Before the stage is packed for transit, adjust the actuators to the center of travel and then tighten the locking mechanism - see Section 3.2.6.

3.7 Dimensions

3.7.1 LNR25M

All Dimensions in inches (mm)

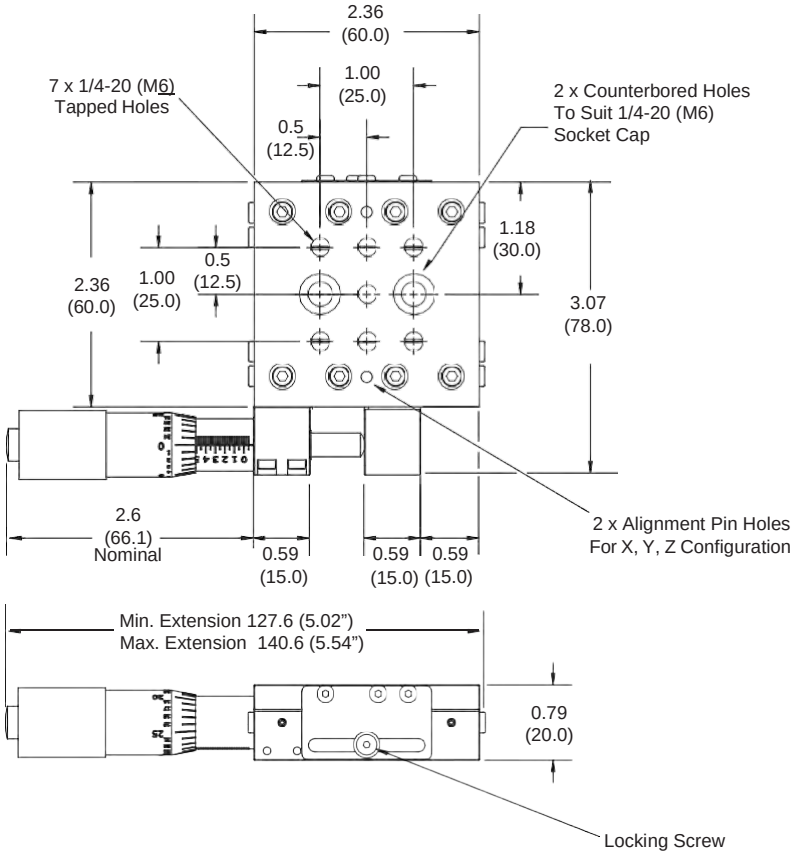


Fig. 3.10 Dimensions – LNR25M (micrometer drives)

3.7.2 LNR25D

All Dimensions in inches (mm)

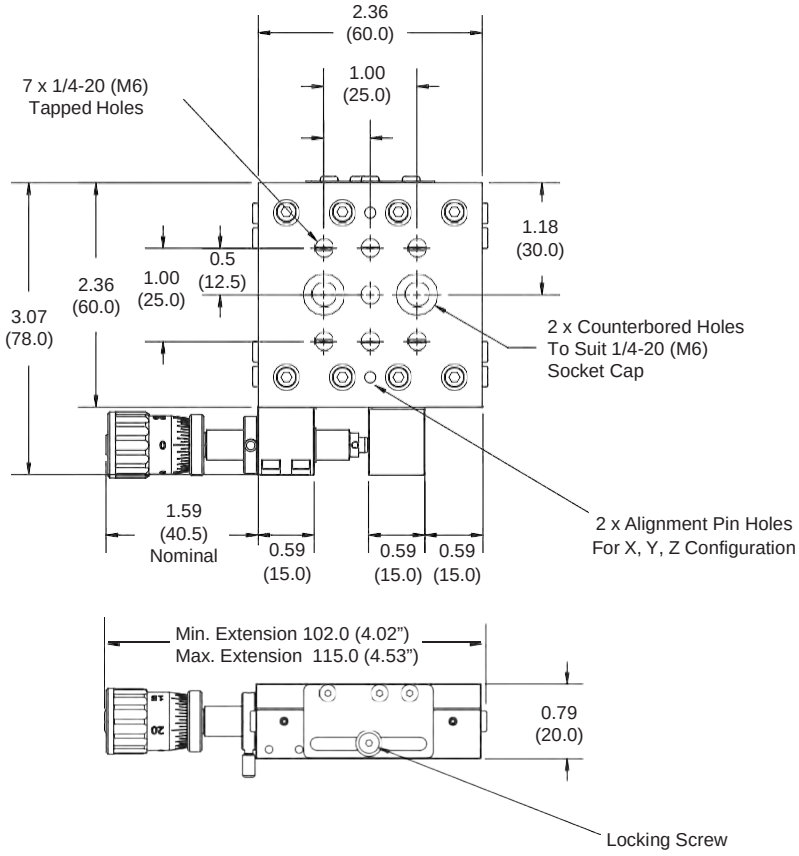


Fig. 3.11 Dimensions – LNR25D (differential drives)

3.7.3 LNR25ZFS

All Dimensions in inches (mm)

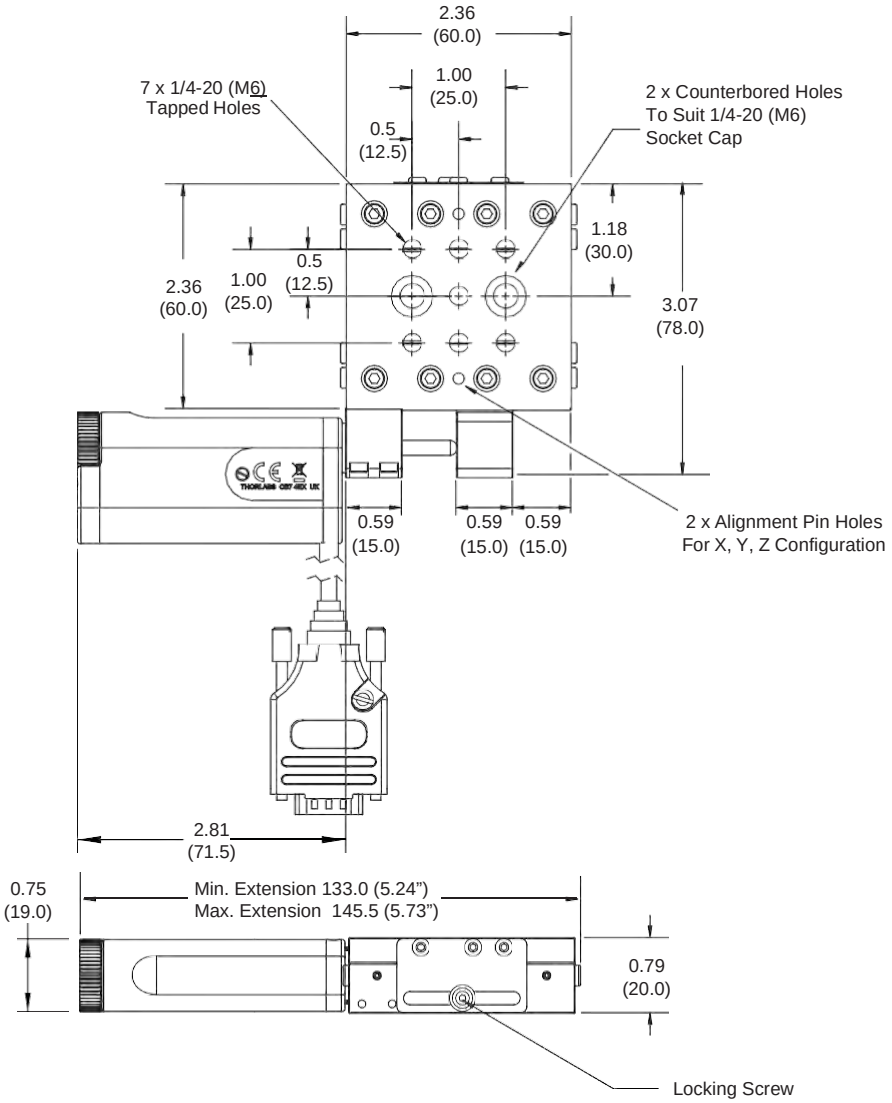


Fig. 3.12 Dimensions – LNR25ZFS (stepper motor drive)

Chapter 4 Operation

4.1 Manual Micrometer and Differential Drives

4.1.1 Adjusting Micrometer Drives

These micrometers are available in imperial and metric versions.

Imperial - The adjustment provides 1” of travel at 0.025” per revolution, with a 0.001” graduated scale

Metric - The adjustment provides 25 mm of travel at 0.5 mm per revolution, with a 10 µm graduated scale.

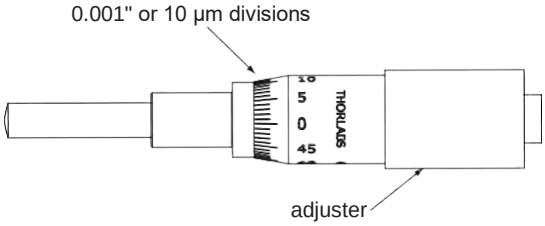


Fig. 4.1 Adjusting a micrometer drive

4.1.2 Adjusting Differential Drives

The coarse adjustment provides 25 mm of travel at 0.5 mm per revolution. The fine (differential) adjustment delivers 250 µm travel at 25 µm per revolution, with a 0.5 µm graduated scale.

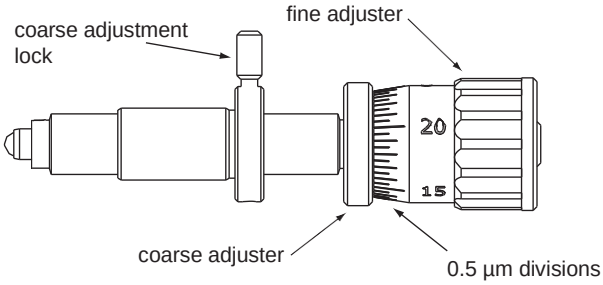
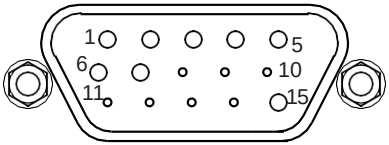


Fig. 4.2 Adjusting a differential drive

4.2 Stepper Motor Operation

This section is applicable to LNR25 stages fitted with stepper motor actuators such as ZFS25B and ZST225B. The pin diagram of the male D-Type connector flying lead is shown in Fig 4.3 and is the same for both these motors.



Pin	Description	Pin	Description
1	Limit Ground	**9**	Reserved for Future Use
2	CCW Limit Switch	**10**	Vcc (+5 VDC)
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		

Fig. 4.3 Motor Output Connector Pin Identification

Caution

DO NOT connect a motor actuator while the K-Cube is powered up.

Only use motor drive cables supplied by Thorlabs, other cables may have incompatible wiring.

For more information on the motors, such as operation of the limit switches, refer to the detailed manuals available for the individual actuators.

4.2.1 Compatible Drivers and Software

The recommended Thorlabs controller for stepper motorized LNR25 stages is the K-Cube Single Channel Stepper Motor Controller KST101. A choice of two software packages is available for running the motors: either Kinesis® or APT™ (Advanced Positioning Technology: version 3.2.0 or higher). These can be downloaded from the software section at www.thorlabs.com.

The following sections (4.2.2 and 4.2.3) give a brief “getting started” outline of the software in both versions; for complete details, refer to the actuator and controller manuals. Kinesis/APT tutorials are also available on the Thorlabs website.

4.2.2 Initial System Setup in APT

To ensure that a particular stage is driven properly in APT, system parameters must first be set using the APT Config utility, which associates a specific stage type with the motor controller. Once this association has been made, the APT server automatically applies suitable default parameter values on boot up of the software.

Note

If the APTConfig utility is not used to associate a particular stage, the software will associate a ZST206 type actuator by default.

Note

To use the increased resolution and velocity functionality offered by these controllers, the stage types prefixed by 'HS' (e.g. HS ZFS25B) must be selected. Failure to select the correct stage type will result in reduced velocity and resolution.

1) Install the electronic hardware and connect the controller to the relevant axes of the associated stage/actuators (see the handbooks supplied with the KST101 Controller).
2) Shut down all applications using the APT server (e.g. APT User or your own custom application).
3) Run the APT Config utility - Start/All Programs/Thorlabs/APT Config/APT Config.
4) From the 'APT Configuration Utility' window, click the 'Stage' tab.

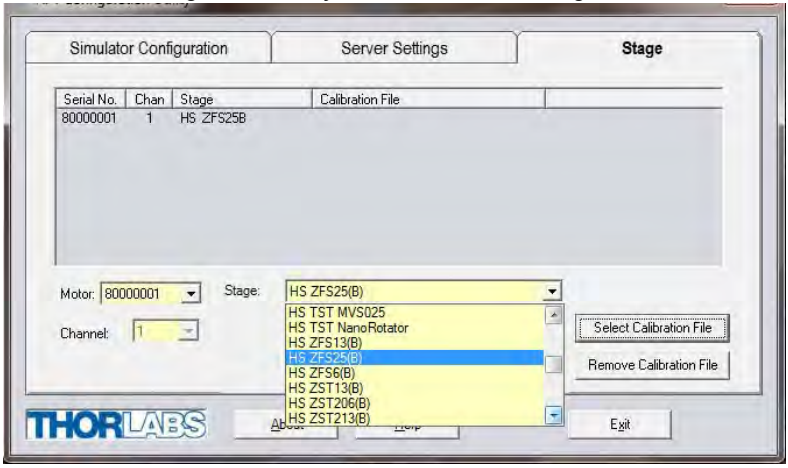


Fig. 4.4 APT Configuration Utility - Stage Tab

5) In the 'Motor' field, select the serial number of the KST101 controller to be configured (this number can be found on the rear panel of the controller unit).

6) In the ‘Stage’ field, select the actuator (e.g. ‘HS ZFS25B’ or HS ZST225B) from the list displayed.
7) Click the 'Add Stage Association' button.
8) 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 onstart up. See the handbook supplied with the stepper motor controller for further information.
9) Close down the APT Config utility.
10) Run the APTUser utility, and operate the stage as described in the handbook for the KST101 driver.

4.2.3 Initial System Setup in Kinesis

The latest version of Kinesis provides automatic recognition of the ZFSxx actuator present through the KST101 controller: on powering up and running the Kinesis software, the motor controller GUI (Fig. 4.5) should therefore directly display the correct actuator type, or it will be available in a drop-down list. If this is not the case, refer to the actuator handbook for advice on manually selecting the correct actuator.

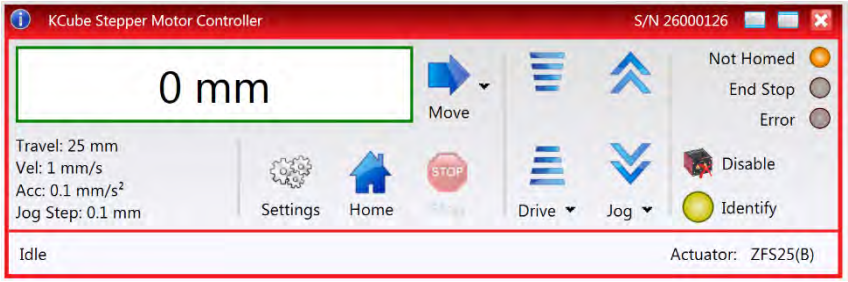


Fig. 4.5 Kinesis Graphical User Interface (GUI) showing the actuator type that is registered (bottom right)

4.2.4 Stepper Motor Actuator Maintenance

Periodic greasing of the actuator lead screw is recommended, particularly in applications with a high duty cycle. Refer to the actuator handbook on details of how to undertake the appropriate maintenance.

Chapter 5 Specifications

5.1 LNR25 with Micrometer and Differential Drives

Parameter	Value
Travel	25 mm (1.0”)
Horizontal Load Capacity	20 kg (44 lbs)
Vertical Load Capacity	8 kg (17.6 lbs)
Runout[a] Over Full Range	± 1.5 µm
Weight (including drives)	LNR25M: 0.57 kg (1.26 lbs) LNR25D: 0.61 kg (1.34 lbs)

[a] Deviation from linearity

5.2 LNR25 with ZFS25B Stepper Motor Drive

Parameter	Value
Travel	25 mm (0.98”)
Horizontal Load Capacity	5 kg (11 lbs)
Vertical Load Capacity	0.5 kg (1.1 lbs)
Runout[a] Over Full Range	± 1.5 µm
Max Velocity[b]	2.0 mm/s
Max Acceleration[b]	10 mm/s^2
Min Incremental Movement[c]	0.46 nm
Absolute On-axis Accuracy	15 µm
Bidirectional Repeatability	±1.5 µm
Home Location Accuracy	±2.5 µm
Weight (including drives)	0.73 kg (1.61 lbs)

[a] Deviation from linearity
[b] At maximum load
[c] Calculated

5.3 LNR25 Stage Construction

The LNR25 stage is an all-steel construction, with crossed roller bearings. The main body is made from EN8 (AISI 1040) with an electroless nickel plating finish.

Chapter 6

Accessories

6.1 Parts List

Description	Part Number
Base plate	LNR25P1
Angle bracket	LNR25P2
Micrometer Drive (Imperial)	150-811ST
Micrometer Drive (Metric)	150-801ME
Differential Drive	DM12
Stepper Motor Drive	ZST225B
Compact Stepper Motor Drive	ZSF25B
Handbook	HA0221T

Chapter 7 Regulatory

7.1 Declarations Of Conformity

7.1.1 For Customers in Europe

This equipment has been tested and found to comply with the EC Directives and standards:

Electrical Equipment for measurement, control and laboratory use - EMC requirements - EN61326-1, 2006

Safety of machinery. General principles for design. Risk assessment and risk reduction - EN ISP 12100, 2010

Machinery Directive (MD) - 2006/42/EC

Electromagnetic Compatibility (EMC) - 2004/108/EC

Restriction of use of certain hazardous substances (RoHS)" - 2011/65/EU

Waste electrical and electronic equipment (WEEE)" - 2002/96/EC

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 Waste Electrical and Electronic Equipment (WEEE) Directive

7.2.1 Compliance

As required by the Waste Electrical and Electronic Equipment (WEEE) Directive of the European Community and the corresponding national laws, we offer all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see Fig. 7.1)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

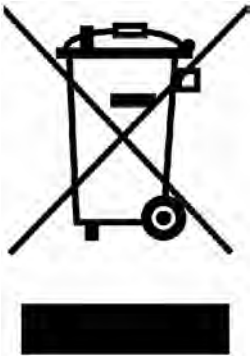


Fig. 7.1 Crossed out "wheelie bin" symbol

As the WEEE directive applies to self contained operational electrical and electronic products, this "end of life" take back service does not refer to other products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

7.2.2 Waste treatment on your own responsibility

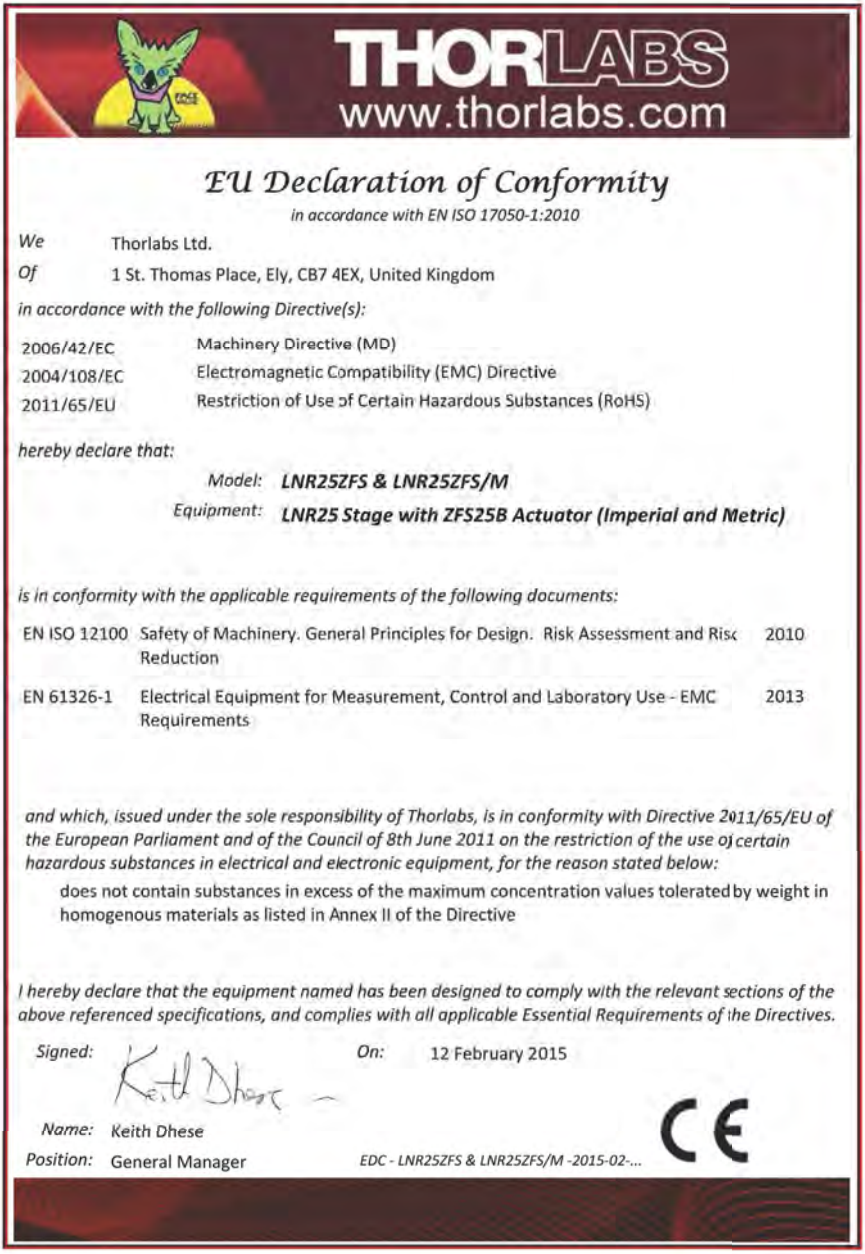
If you do not return an "end of life" unit to the company, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

7.2.3 Ecological background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment

7.3 CE Certificates



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We Thorlabs Ltd.

Of 1 St. Thomas Place, Ely, CB7 4EX, United Kingdom

in accordance with the following Directive(s):

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

hereby declare that:

Model: ***LNR25ZFS & LNR25ZFS/M***

Equipment: ***LNR25 Stage with ZFS25B Actuator (Imperial and Metric)***

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

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risc Reduction	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

and which, issued under the sole responsibility of Thorlabs, 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:

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: Keith Dhese *On:* 12 February 2015

Name: Keith Dhese

Position: General Manager

EDC - LNR25ZFS & LNR25ZFS/M -2015-02-...

CE

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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