

## LNR50S/M - April 7, 2020

Item # LNR50S/M was discontinued on April 7, 2020. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

### LINEAR TRANSLATION STAGES: 50 mm (1.97") TRAVEL, MOTORIZED, CROSSED ROLLER BEARINGS

- ▶ 50 mm (1.97") of Travel
- ▶ Horizontal Load Capacity of 48 lbs (22 kg)
- ▶ Rigid, Durable, Thermally Matched Steel Construction
- ▶ Available With or Without an Optical Encoder



#### OVERVIEW

##### Features

- 50 mm (1.97") Travel Range
- Stage Contains Thirteen 1/4"-20 (M6) Taps
- Rugged, Thermally Matched Steel Construction with Heavy-Duty Crossed Roller Bearings
- Trapezoidal Lead Screw Stepper Motor for Cleaner, More Wear-Resistant Operation
- Adapters Available for Breadboard Mounting and XY, XZ, and XYZ Arrangements
- Offered with or without a Linear Optical Encoder

Thorlabs' LNR50S(M) Motorized Translation Stage features a 50 mm (1.97") travel range and is designed for applications that require stability, long travel, and high load capacity. The stage is equipped with a tapped hole matrix on a moving platform that includes thirteen 1/4"-20 (M6) taps for compatibility with standard optomechanics.

The moving platform contains holes for alignment pins that ensure orthogonality when the stage is stacked with other stages or connected to our accessories. Horizontal loads of 48 lbs (22 kg) and vertical loads of 22 lbs (10 kg) are supported. The rigidity of the thermally matched, all-steel construction, along with the heavy-duty cross-roller bearings, provides precision motion and long life, even in less-than-ideal conditions.

The LNR50S offers a minimum repeatable incremental movement of 1  $\mu$ m. For even more precise movement, we offer the LNR50SE(M) Encoded Translation Stage, which combines a linear optical encoder and everything included with the LNR50S stage to achieve a minimum repeatable incremental movement of 0.1  $\mu$ m.

##### Mounting Adapters and Stage Combinations

Thorlabs manufactures three adapter plates to maximize the mounting flexibility of the LNR50S stage. The LNR50P2(M) Right-Angle Bracket and LNR50P3(M) Spacer Plate allow for easy configuration of left- or right-handed XY, XZ, or XYZ systems. A base plate is included with the LNR50S and LNR50SE stages and provides sufficient clearance between the stage and the work surface for the operation of the previous-generation DRV014 stepper motor actuator. Replacement stepper motor actuators are available (item # DRV250); if using the replacement actuator, it will be necessary to swap the included base plate for the LNR50P4 base plate (sold below).

Motorized Linear Translation Stages	
12 mm	Standard
25 mm	Compact
	Standard
	TravelMax
50 mm	Compact
	Direct-Drive Servo
	TravelMax
Long Travel: 100 mm to 300 mm	

##### Key Specifications<sup>a</sup>

Item #	LNR50S	LNR50SE
Travel Range	50 mm (1.97")	
Velocity (Max)	20 mm/s	
Min Achievable Incremental Movement <sup>b</sup>	0.05 $\mu$ m	
Bidirectional Repeatability <sup>c</sup>	0.5 $\mu$ m	0.3 $\mu$ m
Backlash <sup>d</sup>	<6 $\mu$ m	
Horizontal Load Capacity (Max)	48 lbs (22 kg)	
Vertical Load Capacity (Max)	22 lbs (10 kg)	
Included Actuator	DRV014 Stepper Motor <sup>e</sup>	
Cable Length	500 mm (1.64 ft)	
Recommended Controller	APT™ Stepper Motor Controllers	

<sup>a</sup>Please see the Specs tab for a complete specifications list.

<sup>b</sup>The measured minimum incremental motion that the stage can achieve, also referred to as the minimum step size.

<sup>c</sup>The average of the repeatability when a set position is approached from both directions.

<sup>d</sup>When a stage is moved to a position and then returned to its original position, some motion is lost due to the lead screw mechanism. This loss is known as backlash.

<sup>e</sup>This previous-generation item is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used.



Click to Enlarge  
LNR50S TravelMax Stage with a PAS009 Piezo Actuator in Place of Static Pin

**Included Actuator**

The translation stages sold here include a DRV014\* stepper motor actuator. For applications requiring fine positioning, the removable static pin that provides a stop for the stage's motor drive can be replaced by a piezo drive, as shown in the photo on the right. Combining the standard stepper motor actuator with a piezo drive allows for both long travel and fine adjustment. Both open-loop and closed-loop piezo drives are available with 20 µm to 100 µm of travel and resolution as low as 5 nm.

\*This previous-generation actuator is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used. Note that the included base plate does not provide sufficient clearance for the full travel range of the DRV250 actuator, and only the LNR50P4 base plate (sold below) should be used with the DRV250 actuator.

**Controller Options**

For stepper motors such as the one included with the LNR50S(M) and LNR50SE(M) stages, Thorlabs recommends using a BSC201, BSC202, or BSC203 Stepper Motor Controller. Any of these controllers can be purchased separately.

Thorlabs also manufactures the MTS50-Z8 Motorized Translation Stage, which features a built-in actuator and reduced overall package size.

**S P E C S**

**Motor Specifications**

Parameter	Value
Motor Type	DRV014 <sup>a</sup> Stepper Motor
Cable Length	500 mm (1.64 ft)
Leadscrew Pitch	1 mm
Limit Switches	Ceramic-Tipped, Electro-Mechanical Switches
Maximum Speed	20 mm/s
Step Angle	1.8°
Rated Phase Current	1 A
Phase Resistance	3.6 Ω
Phase Inductance	4.6 mH
Holding Torque	23.1 N·cm
Detent Torque	1.7 N·cm
Rotor Inertia	32 g·cm <sup>2</sup>

a. This previous-generation actuator is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used.

**Stage Specifications**

Item #	LNR50S(M)	LNR50SE(M)
<b>Translation</b>		
Travel Range	50 mm (1.97")	
Bidirectional Repeatability <sup>a</sup>	0.5 µm	0.3 µm
Backlash <sup>b</sup>	<6 µm	
Min Achievable Incremental Movement <sup>c,d</sup>	0.05 µm	
Min Repeatable Incremental Movement <sup>d,e</sup>	1 µm	0.1 µm
Home Location Accuracy	±1.0 µm	
<b>Motion Parameters</b>		
Velocity (Max)	20 mm/s	
Velocity Stability	±0.4 mm/s	
Acceleration (Max)	20 mm/s <sup>2</sup>	
<b>Load Capacity</b>		
Vertical Load	Recommended: <sup>f</sup> ≤10 kg (22 lbs) Max: 10 kg (22 lbs)	
Horizontal Load	Recommended: <sup>f</sup> ≤25 kg (55 lbs) Max: 48 kg (22 lbs)	
<b>Orthogonality</b>		
Pitch	0.03° (524 µrad)	
Yaw	0.015° (262 µrad)	
Absolute On-axis Accuracy	10 µm	3 µm Over Full Travel
Percentage Accuracy (Max)	0.02%	
<b>Physical</b>		
Dimensions	11.55" x 5.59" x 1.88" (293.4 mm x 142 mm x 47.9 mm)	
Weight	2.82 kg (6.22 lb)	

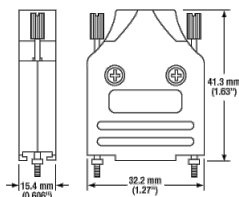
- a. The average of the repeatability when a set position is approached from both directions.
- b. When a stage is moved to a position and then returned to its original position, some motion is lost due to the lead screw mechanism. This loss is known as backlash.
- c. The measured minimum incremental motion that the stage can achieve, also referred to as the

- minimum step size.
- d. If Used with a BSC201, BSC202, or BSC203 Controller
- e. The minimum incremental motion that the stage can repeatedly achieve within its standard error.
- f. Under Continuous Use

## PIN DIAGRAM

Please refer to the descriptions below if you wish to use your own controller with the TravelMax stage. The pins detailed in this table can be identified on the cable by their numbers, directly written on the cable's D-type connector.

### HD15 D-Sub Female



Pin Number	Description
1	Ground
2	Counter-Clockwise Limit Switch Output
3	Clockwise Limit Switch Output
4	Stepper Motor Phase B-
5	Stepper Motor Phase B+
6	Stepper Motor Phase A-
7	Stepper Motor Phase A+
8 - 14	Not Used
15	Not Used

## MOTION CONTROL SOFTWARE

Thorlabs offers two platforms to drive our wide range of motion controllers: our Kinesis<sup>®</sup> software package or the legacy APT<sup>™</sup> (Advanced Positioning Technology) software package. Either package can be used to control devices in the Kinesis family, which covers a wide range of motion controllers ranging from small, low-powered, single-channel drivers (such as the K-Cubes<sup>™</sup> and T-Cubes<sup>™</sup>) to high-power, multi-channel, modular 19" rack nanopositioning systems (the APT Rack System).

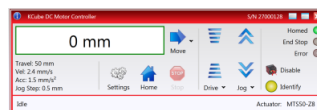
The Kinesis Software features .NET controls which can be used by 3rd party developers working in the latest C#, Visual Basic, LabVIEW<sup>™</sup>, or any .NET compatible languages to create custom applications. Low-level DLL libraries are included for applications not expected to use the .NET framework. A Central Sequence Manager supports integration and synchronization of all Thorlabs motion control hardware.

Our legacy APT System Software platform offers ActiveX-based controls which can be used by 3rd party developers working on C#, Visual Basic, LabVIEW<sup>™</sup>, or any Active-X compatible languages to create custom applications and includes a simulator mode to assist in developing custom applications without requiring hardware.

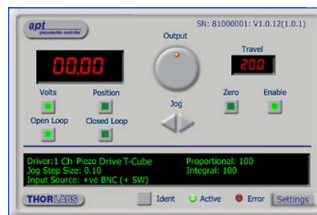
By providing these common software platforms, Thorlabs has ensured that users can easily mix and match any of the Kinesis and APT controllers in a single application, while only having to learn a single set of software tools. In this way, it is perfectly feasible to combine any of the controllers from single-axis to multi-axis systems and control all from a single, PC-based unified software interface.

The software packages allow two methods of usage: graphical user interface (GUI) utilities for direct interaction with and control of the controllers 'out of the box', and a set of programming interfaces that allow custom-integrated positioning and alignment solutions to be easily programmed in the development language of choice.

A range of video tutorials is available to help explain our APT system software. These tutorials provide an overview of the software and the APT Config utility. Additionally, a tutorial video is available to explain how to select simulator mode within the software, which allows the user to experiment with the software without a controller connected. Please select the *APT Tutorials* tab above to view these videos.



Kinesis GUI Screen



APT GUI Screen

### Software

#### Kinesis Version 1.14.23

The Kinesis Software Package, which includes a GUI for control of Thorlabs' Kinesis and APT<sup>™</sup> system controllers.

#### Also Available:

- Communications Protocol



### Software

#### APT Version 3.21.4

The APT Software Package, which includes a GUI for control of Thorlabs' APT<sup>™</sup> and Kinesis system controllers.

#### Also Available:

- Communications Protocol



[Hide APT Tutorials](#)

## APT TUTORIALS

These videos illustrate some of the basics of using the APT System Software from both a non-programming and a programming point of view. There are videos that illustrate usage of the supplied APT utilities that allow immediate control of the APT controllers out of the box. There are also a number of videos that explain the basics of programming custom software applications using Visual Basic, LabView and Visual C++. Watch the videos now to see what we mean.



[Click here to view the video tutorial](#)



To further assist programmers, a guide to programming the APT software in LabView is also available.



[Click here to view the LabView guide](#)



## SELECTION GUIDE

The table below compares the key specifications of our 50 mm (1.97") linear translation stages. Additional specifications are listed in the *Specs* tab on the webpage of the particular stage.

Item #	MTS50-Z8 (MTS50/M-Z8)	LNR50S (LNR50S/M)	LNR50SE (LNR50SE/M)
<b>Travel Range</b>	50 mm (1.97")	50 mm (1.97")	50 mm (1.97")
<b>Min Achievable Incremental Movement</b>	0.1 $\mu\text{m}$	0.05 $\mu\text{m}$ <sup>a</sup>	0.05 $\mu\text{m}$ <sup>a</sup>
<b>Min Repeatable Incremental Movement</b>	0.8 $\mu\text{m}$	1 $\mu\text{m}$	0.1 $\mu\text{m}$
<b>Bidirectional Repeatability</b>	1.6 $\mu\text{m}$	0.5 $\mu\text{m}$	0.3 $\mu\text{m}$
<b>Backlash</b>	<6 $\mu\text{m}$	<6 $\mu\text{m}$	<6 $\mu\text{m}$
<b>Max Horizontal Load Capacity</b>	25 lbs (12 kg)	48 lbs (22 kg)	48 lbs (22 kg)
<b>Max Vertical Load Capacity</b>	10 lbs (4.5 kg)	22 lbs (10 kg)	22 lbs (10 kg)
<b>Angular Deviation</b>	Pitch: 0.05° (873 $\mu\text{rad}$ ) Yaw: 0.06° (1047 $\mu\text{rad}$ )	Pitch: 0.03° (524 $\mu\text{rad}$ ) Yaw: 0.015° (262 $\mu\text{rad}$ )	Pitch: 0.03° (524 $\mu\text{rad}$ ) Yaw: 0.015° (262 $\mu\text{rad}$ )
<b>Max Velocity</b>	2.4 mm/s	20 mm/s	20 mm/s
<b>Mounting Features</b>	Eighteen 4-40 (M3) Taps and One 8-32 (M4) Tap	Thirteen 1/4"-20 (M6) Taps	Thirteen 1/4"-20 (M6) Taps
<b>Included Actuator</b>	Built-In DC Servo	DRV014 <sup>b</sup> Stepper Motor	DRV014 <sup>b</sup> Stepper Motor
<b>Cable Length</b>	500 mm (1.64 ft)	500 mm (1.64 ft)	500 mm (1.64 ft)
<b>Physical Dimensions<sup>c</sup> (L x W x H)</b>	6.33" x 1.69" x 0.87" (160.8 mm x 42.9 mm x 22.1 mm)	11.55" x 5.59" x 1.88" (293.4 mm x 142 mm x 47.9 mm)	11.55" x 5.59" x 1.88" (293.4 mm x 142 mm x 47.9 mm)

a. If Used with a BSC201, BSC202, or BSC203 Controller

b. This previous-generation item is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used.

c. When stage is fully retracted.

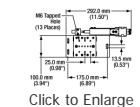
### 50 mm (1.97") TravelMax Translation Stage without Optical Encoder



- ▶ DRV014\* Stepper Motor Provides 50 mm (1.97") Travel
- ▶ Min Repeatable Incremental Movement of 1  $\mu\text{m}$  when used with a Stepper Motor Controller
- ▶ Includes Thirteen 1/4"-20 (M6) Tapped Holes
- ▶ Includes Six Dowel Alignment Pins for Use with Mounting Accessories
- ▶ Controller Sold Separately



[Click to Enlarge Schematic of Imperial Version](#)



[Click to Enlarge Schematic of Metric Version](#)

Thorlabs' LNR50S(M) TravelMax Translation Stage is designed for long travel and a high horizontal load capacity of 48 lbs (22 kg). The stage is made from thermally matched steel for high stability even in less-than-ideal conditions. For compatibility with a wide variety of optomechanical setups, the stage features a 3.94" x 3.94" (100.0 mm x 100.0 mm) moving platform with thirteen 1/4"-20 (M6) tapped holes and can be stacked with additional LNR50S stages in XY, XZ, and XYZ configurations using the adapters sold below.

The stage comes preassembled with a DRV014\* Stepper Motor Drive, which requires a separately purchased controller. We recommend using our BSC201, BSC202, or BSC203 Stepper Motor Controllers for optimal performance and a minimum achievable incremental movement of 0.05  $\mu\text{m}$ .

The motor cable that is built into the DRV014 actuator is 500 mm (1.64 ft) long. A 3 m (9.8 ft) PAA613 cable is included with this stage for use with our benchtop controllers. Replacement cables are available at the bottom of the page.

\*This previous-generation actuator is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used. Note that the included base plate does not provide sufficient clearance for the full travel range of the DRV250 actuator, and only the LNR50P4 base plate (sold below) should be used with the DRV250 actuator.

Part Number	Description	Price	Availability
LNR50S/M	50 mm (1.97") TravelMax Translation Stage, M6 Taps	\$2,091.73	Lead Time
LNR50S	50 mm (1.97") TravelMax Translation Stage, 1/4"-20 Taps	\$2,091.73	Lead Time

### 50 mm (1.97") TravelMax Translation Stage with Optical Encoder

- ▶ DRV014\* Stepper Motor Provides 50 mm (1.97") Travel
- ▶ Min Repeatable Incremental Movement of 0.1



- µm when used with a Stepper Motor Controller
- ▶ Includes Thirteen 1/4"-20 (M6) Tapped Holes
- ▶ Includes Six Dowel Alignment Pins for Use with Mounting Accessories
- ▶ Controller Sold Separately

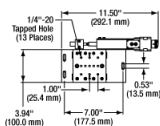
The LNR50SE(M) TravelMax Translation Stage combines the LNR50S(M) TravelMax translation stage (sold above) with an integrated linear optical encoder that reduces the minimum repeatable incremental movement from 1 µm to 0.1 µm. It is designed for applications where stability, long travel, and high horizontal load capacity of 48 lbs (22 kg) need to be coupled with absolute position accuracy.

Dedicated software that takes full advantage of the high-resolution linear optical encoder is included. This software, when combined with one of Thorlabs' BSC201, BSC202, or BSC203 closed-loop stepper motor controllers, can provide an application solution that is fully operational out of the box.

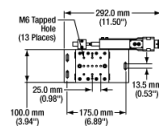
This translation stage's linear optical encoder is directly attached to the stage's moving platform to provide the necessary feedback to the drive electronics. Since the encoder provides a direct readout of the absolute position, the mechanical positioning errors associated with backlash can be ignored. The glass scale encoder system has a resolution of 0.1 µm, leading to a positional accuracy that is better than 3 µm over the full 50 mm of travel. Furthermore, the bidirectional repeatability is 0.3 µm.

The motor cable that is built into the DRV014 actuator is 500 mm (1.64 ft) long. A 3 m (9.8 ft) PAA613 cable is included with this stage for use with our benchtop controllers. Replacement cables are available at the bottom of the page.

\*This previous-generation actuator is not available for individual purchase. If a replacement is needed, the DRV250 actuator can be used. Note that the included base plate does not provide sufficient clearance for the full travel range of the DRV250 actuator, and only the LNR50P4 base plate (sold below) should be used with the DRV250 actuator.



Click to Enlarge  
Schematic of Imperial Version



Click to Enlarge  
Schematic of Metric Version

Encoder Specifications	
Type	Optical Grating Incremental Encoder
Resolution	0.1 µm
Bidirectional Repeatability	0.3 µm
Absolute On-axis Accuracy	3 µm Over the Full Travel

Part Number	Description	Price	Availability
LNR50SE/M	50 mm (1.97") TravelMax Translation Stage, M6 Taps, Encoded	\$4,027.64	Lead Time
LNR50SE	50 mm (1.97") TravelMax Translation Stage, 1/4"-20 Taps, Encoded	\$4,027.64	Lead Time

### Base Plate for Breadboards and Optical Tables



- ▶ Provide Clearance Between the Stage and the Work Surface
- ▶ Dowel Pin Holes to Ensure Orthogonality (2 Dowel Pins Included)
- ▶ Required for use with DRV250 Stepper Motor Actuator
- ▶ Made from Aluminum Alloy

The LNR50P4(M) base plate provides the necessary clearance between the stage and the work surface for use of the DRV250 stepper motor actuator. The base plate included with the LNR50S(M) and LNR50SE(M) stages does not provide sufficient clearance for this actuator, and only the LNR50P4(M) base plate should be used with the DRV250 actuator.

The LNR50P4(M) plate has seven counterbored slots. Two pairs of 1/4"-20 tapped holes and two pairs of dowel pin holes allow a stage to be mounted and aligned in multiple orientations. Two dowel pins are included.



Click to Enlarge  
[APPLIST] | [APPLIST]  
LNR50 Series Stage with DRV250 Stepper Motor Actuator Mounted on LNR50P4 Base Plate

Part Number	Description	Price	Availability
LNR50P4/M	Base Plate for LNR50 TravelMax Stages, Metric	\$80.00	Today
LNR50P4	Base Plate for LNR50 TravelMax Stages, Imperial	\$80.00	Today

### XY Mounting Adapter



- ▶ Allows for XY Translation Stage Configurations
- ▶ Dowel Pin Holes to Ensure Orthogonality (8 Dowel Pins Included)
- ▶ Dimensions (L x W x H): 3.94" x 3.94" x 0.94" (100 mm x 100 mm x 24 mm)

The LNR50P3(M) XY Mounting Adapter provides the necessary clearance between separate LNR50S(M) and LNR50SE(M) translation stages for a left- or right-handed XY translation stage configuration. On the adapter, there are six 1/4"-20 (M6) tapped holes, four dowel pin holes, one counterbore for 1/4"-20 (M6) cap screws, and two Ø0.29" (7.5 mm) through holes. An example of an XY arrangement is shown to the right. This was assembled using the LNR50P3 Mounting Adapter, LNR50P4 Base Plate, and two LNR50 Series Translation Stages. By incorporating a third translation stage and an LNR50P2(M) Right-Angle Bracket (sold below), a left- or right-handed XYZ translation stage can also be constructed. Dowel pins are included for easy alignment of the stage.



Click to Enlarge  
[APPLIST] | [APPLIST]  
XY Configuration Using LNR50 Series Stages

Part Number	Description	Price	Availability
LNR50P3/M	XY Adapter Plate for LNR50 TravelMax Stages, Metric Hole Spacings	\$61.42	Today
LNR50P3	XY Adapter Plate for LNR50 TravelMax Stages, Imperial Hole Spacings	\$61.42	Today

### Right-Angle Bracket



- ▶ Mount an LNR50S(M) or LNR50SE(M) Translation Stage in the Vertical Plane
- ▶ Dowel Pin Holes to Ensure Orthogonality (6 Dowel Pins Included)
- ▶ Dimensions (L x W x H): 4.25" x 3.46" x 5.26" (108 mm x 88 mm x 134 mm)

The LNR50P2(M) is an anodized aluminum right-angle bracket that orients the LNR50S(M) and LNR50SE(M) translation stages in a vertical orientation. This allows for the construction of XZ and XYZ translation stage configurations.

The base of the LNR50P2 contains six counterbored holes for 1/4"-20 (M6) cap screws, allowing it to be attached to the top of an LNR50 series stage or directly to an optical table. The vertical side has two 1/4"-20 (M6) tapped holes and eight Ø0.28" (7.0 mm) through holes.

The XYZ assembly shown to the right was constructed using the LNR50P2 Right-Angle Bracket, LNR50P3 Adapter Plate, LNR50P4 Base Plate, and three LNR50S translation stages. The LNR50P4 and LNR50P3 Mounting Adapters are sold above. Dowel pins are included with the base plate, adapter plate, and right-angle bracket to assist in alignment of the stage.



Click to Enlarge  
[\[APPLIST\]](#) | [\[APPLIST\]](#)  
 A 3-axis LNR50DD 2" travel stage shown with the manual adjusters replaced by DRV250 actuators.

Part Number	Description	Price	Availability
LNR50P2/M	Right-Angle Bracket for LNR50 TravelMax Stages, Metric Threads	\$123.04	Today
LNR50P2	Right-Angle Bracket for LNR50 TravelMax Stages, Imperial Threads	\$123.04	Today

### Replacement Cables



- ▶ Replacement Motor Drive Cables
- ▶ Available Lengths: 1 m (3.3') and 3 m (9.9')

These motor cables are sold as replacements for the lost or damaged PAA613 Motor Drive Cable that is included with our Motorized LNR50 Series Translation Stages. They are also compatible with our stepper motor actuators. The male end connects to the controller and the female end connects to the motor.

Part Number	Description	Price	Availability
PAA612	APT Stepper Motor Cable, DA15 Male to DE15 Female, 1 m	\$63.04	Today
PAA613	APT Stepper Motor Cable, DA15 Male to DE15 Female, 3 m	\$75.48	Today