THORLABS

LTS150C(/M), LTS300C(/M), LTS450C(/M) and LTS600C(/M) Long Travel Stages

User Guide



Table of Contents

Chapter 1 Introduction 1
- **1.1 Intended Use 1**
- **1.2 Explanation of Safety Warnings 1**
- **1.3 Description 2**
- **1.4 Kinesis Software Overview 3**
  - 1.4.1 Kinesis Server 3
  - 1.4.2 Software Upgrades 4
- **1.5 Technical Data 5**
  - 1.5.1 Controller Specifications 5
  - 1.5.2 Stage Specifications 5
  - 1.5.3 Motor Specifications 6
  - 1.5.4 Parts List 6
  - 1.5.5 Mechanical Drawings 7
- **1.6 Simplified Declaration of Conformity 11**
- **1.7 FCC Designation 11**

Chapter 2 Safety 12

Chapter 3 Installation 13
- **3.1 Warranty Information 13**
- **3.2 Unpacking 13**
- **3.3 Mounting to a Work Surface 13**
- **3.4 Mounting in a Multi-Axis Configuration 15**
- **3.5 Calibrating the Motor Drives 16**
- **3.6 Attaching Equipment and Devices 17**
- **3.7 Transporting the Unit 17**
- **3.8 Installing the Software 17**
- **3.9 Connecting the Hardware 18**
- **3.10 Verify Software Operation 19**

Chapter 4 Operation 20
- **4.1 Standalone Operation 20**
  - 4.1.1 Control Keypad 20
  - 4.1.2 Potentiometer Operation 21
  - 4.1.3 Button Operation 21
  - 4.1.4 Stopping the Stage 21
- **4.2 PC Operation 22**
  - 4.2.1 Using the Kinesis Software 22
  - 4.2.2 Homing Motors 22
  - 4.2.3 Changing Motor Parameters and Moving to an Absolute Position 23
  - 4.2.4 Stopping the Stage 23
  - 4.2.5 Jogging 24
  - 4.2.6 Setting Move Sequences 24
  - 4.2.7 Changing and Saving Parameter Settings 24

Chapter 5 Maintenance and Cleaning 25
- **5.1 Safety Testing 25**

5.2 Cleaning 25
Chapter 6 Troubleshooting and Repair 26
Chapter 7 Disposal 27
Chapter 8 Software Reference 28
8.1 Introduction 28
8.2 GUI Panel 28
8.2.1 Keyboard Shortcuts 29
8.3 Settings Panel 30
8.3.1 Persisting Settings to Hardware 30
8.3.2 Moves/Jogs Tab 30
8.3.3 Calibration Tab 32
8.3.4 Stage/Axis Tab 33
8.3.5 Advanced Tab 34
Chapter 9 Stepper Motor Operation 36
9.1 How a Stepper Motor Works 36
9.1.1 General Principle 36
9.1.2 Positive and Negative Modes 36
9.1.3 Velocity Profiles 36
9.2 Positioning a Stage 38
9.2.1 General 38
9.2.2 Home Position 38
9.2.3 Limit Switches 38
9.2.4 Minimum and Maximum Positions 39
9.2.5 Power Saving 39
9.3 Error Correction 40
Chapter 10 Thorlabs Worldwide Contacts 41

Chapter 1 Introduction

1.1 Intended Use

The LTS Series stages are a range of stepper-motor driven long travel stages with ranges of:

- 150 mm
- 300 mm
- 450 mm
- 600 mm

They are optimized for applications requiring high load capacity and high resolution, such as measurement and inspection. They are highly suited to applications such as interferometry and M2 measurements and are compatible with our range of optomech and translation stages. The heavy-duty aluminum construction and small moving platform height (40 mm for LTS150 and LTS300, 45 mm for LTS450 and LTS600) makes this stage ideal for applications where space is limited.

They are intended for indoor use only and can be used in for example, optical, robotics and instrumentation environments. They should not be used in explosive, humid or dirty environments. To ensure reliable operation, the unit should not be exposed to corrosive agents or excessive moisture, heat or dust.

NOTICE

Impairment of protection and warranty
If this equipment is used in a manner not specified by the manufacturer, its protection may be impaired. The product may only be used in accordance with the instructions described in this manual. Any other use will invalidate the warranty.

1.2 Explanation of Safety Warnings

⚠WARNING Warning indicates a hazard with a medium level of risk that, if not avoided, could result in death or serious injury.

⚠CAUTION Caution indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.

NOTICE Indicates information considered important, but not hazard-related, such as possible damage to the product.

CE
UK CA

The CE/UKCA markings on the product are the manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety, and environmental protection legislation.

The symbol on the product, the accessories or packaging indicates that this device must not be treated as unsorted municipal waste but must be collected separately.

1.3 Description

The LTS Series stages are designed to be light-weight, compact and robust with high performance over the full travel range. Features include:

- A Load Capacity Of Up To 15 kg Horizontally and 4 kg Vertically
- Integrated Magnetic Limit Switches To Allow For Homing As Well As Overdriving Protection in Both Directions
- A Precision-Ground Lead Screw Delivering Smooth, Virtually Noise-Free Movement

The power supply provided with the stage operates with 90 - 264 VAC input voltages (47 - 63 Hz) and is shipped with a location-specific power cord.

The stages are inclusive of the drive electronics which can either be driven via a PC with Thorlabs' Kinesis® or XA software applications or can be controlled manually via the buttons and velocity potentiometer on the control keypad.



Figure 1 LTS150C, LTS300C, LTS450C and LTS600C Long Travel Stages

1.4 Kinesis Software Overview

The LTS series stages share many of the benefits of the Thorlabs range of motor controllers. These include USB connectivity (allowing multiple units to be used together on a single PC), fully featured Graphical User Interface (GUI) panels, and extensive software function libraries for custom application development.

The LTS stages are fully compatible with Thorlabs' Kinesis and XA software applications. The remainder of this manual describes the use of the controllers with Kinesis software. For information about operation using Thorlabs' XA software, refer to the XA User Guide.

The Kinesis software suite provides a flexible and powerful PC-based control system both for users of the equipment, and software programmers aiming to automate its operation.

The GUI allows full control of all settings and operating modes enabling complete 'out-of-box' operation without the need to develop any further custom software. It provides all the necessary system software services such as generation of GUI panels, communications handling for multiple USB units, and logging of all system activity to assist in hardware troubleshooting. The Kinesis server is also used by software developers to allow the creation of advanced automated positioning applications very rapidly and with great ease.

1.4.1 Kinesis Server

Kinesis controls are re-usable compiled software components that supply both a Graphical User Interface (GUI) and a programmable interface. Many such controls are available for Windows® applications development, providing a large range of re-usable functionality. For example, there are controls available that can be used to manipulate image files, connect to the internet, or simply provide user interface components such as buttons and list boxes.

With the Kinesis system, .Net controls are deployed to allow direct control over and reflect the status of the range of electronic controller units, including the LTS series stages. Software applications that use .Net controls are often referred to as 'client applications'. A .Net control is a language-independent software component. Consequently, the controls can be incorporated into a wide range of software development environments for use by client application developers. Development environments supported include Visual Basic, Labview, Visual C++, C++ Builder, HPVEE, Matlab, VB.NET, C#.NET and, via VBA, Microsoft Office applications such as Excel and Word.

Consider the control supplied for the LTS300C integrated stage as shown in Figure 2.

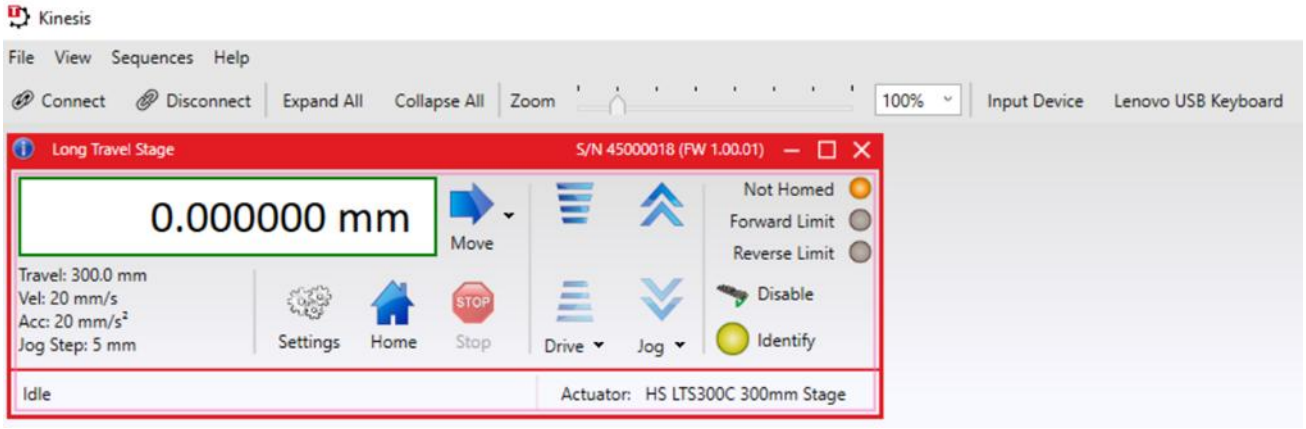


Figure 2 LTS300C Kinesis Server

This control provides a complete GUI instrument panel to allow the stage to be manually operated, as well as a complete set of software functions (often called methods) to allow all parameters to be set and motor operations to be automated by a client application. The instrument panel reflects the current operating state of the controller unit to which it is associated (for example, a motor position). Updates to the panel take place automatically when a user (client) application is making software calls into the same control. For example, if a

client application instructs the associated stage to move, the progress of that move is reflected automatically by changing position readouts on the GUI, without the need for further programming intervention.

The Kinesis controls collection provides a rich set of GUI user panels and programmable interfaces allowing users and client application developers to interact seamlessly with the Kinesis hardware. Each of the Kinesis controllers has an associated .Net control and these are described fully in the handbooks associated with the controllers.

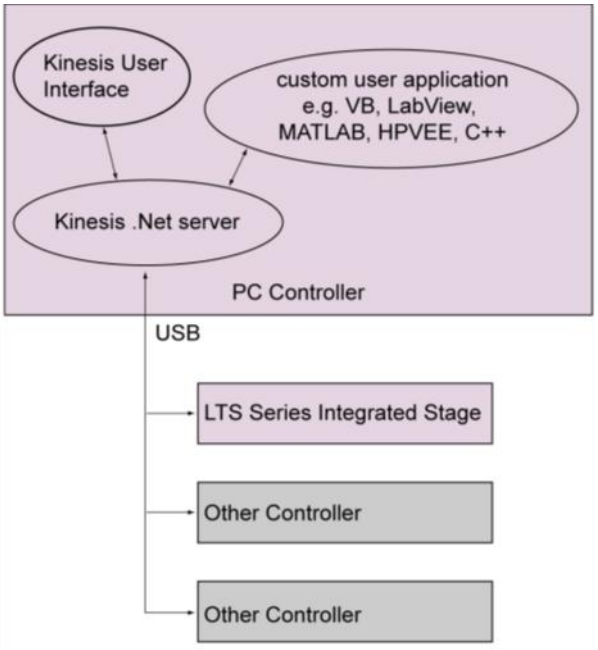


Figure 3 System Architecture Diagram

Refer to the main Kinesis Software online help file, for a complete programmer's guide and reference material on using the Kinesis controls collection. This is available either by pressing the F1 key when running the Kinesis server, or via the Start menu, **Start/Programs/Thorlabs/Kinesis/Kinesis Help**.

1.4.2 Software Upgrades

Thorlabs operate a policy of continuous product development and may issue software upgrades as necessary. The latest software can be downloaded from the **Services** section of www.thorlabs.com.

1.5 Technical Data

1.5.1 Controller Specifications

Item #	Value
Microsteps per Full Step	2048
Microsteps per Revolution of Motor	409,600 (for 200 step motor)
Motor Drive Voltage	24 V
Motor Drive Power	Up to 25 W (Peak)/ 12.5 W (Avg)
Motor Speeds	Up to 3000 RPM (200 Full Step Motor)

1.5.2 Stage Specifications

Item #	Value			
	LTS150C(/M)	**LTS300C(/M)**	**LTS450C(/M)**	**LTS600C(/M)**
Bidirectional Repeatability	< ±2 µm			
Calibrated On - Axis Accuracy	< ±5 µm			
Backlash	2 µm			
Maximum Horizontal Acceleration	50 mm/sec^2		35 mm/sec^2	
Maximum Vertical Acceleration	5 mm/sec^2			
Maximum Horizontal Velocity	50 mm/s			35 mm/s
Maximum Vertical Velocity	3 mm/s			
Velocity Stability	± 1 mm/sec			
Max Load Capacity	15 kg Horizontal, 4 kg Vertical			
Recommended Horizontal Load Capacity	< 12 kg			
Minimum Achievable Incremental Movement	0.1 µm			
Minimum Repeatable Incremental Movement	4 µm			
Home Location Accuracy	±0.6 µm			
Pitch	<0.016° (279 µrad)	<0.022° (384 µrad)	<0.014° (250 µrad)	<0.020° (350 µrad)
Yaw	<0.050° (873 µrad)	<0.060° (1047 µrad)	<0.032° (550 µrad)	<0.046° (800 µrad)
Construction	Aluminum with precision, recirculating linear bearings			
Weight	2.28 kg (5.03 lbs)	3 kg (6.61 lbs)	4.8 kg (10.58 lbs)	5.7 kg (12.62 lbs)
USB Cable Length	1.5 m (4.92')			

NOTICE

The max velocity and acceleration values quoted are achievable with lighter loads. As the load increases, the velocity and acceleration decreases. For a maximum 15 kg load, the velocity reduces to either 15 mm/s with an acceleration of 3 mm/s^2 or 12 mm/sec with an acceleration of 5 mm/s^2, depending upon whether speed or acceleration is more important for the intended application.

1.5.3 Motor Specifications

Item #	Value
Step Angle	1.8°
Step Accuracy	5%
Rated Phase Current	0.85 A
Phase Resistance	5.4 Ohms
Phase Inductance	5.6 mH
Holding Torque	20 N·cm
Detent Torque	2.0 N·cm
Operating Temperature	-20°C to +40°C (Motor Specification Only)

1.5.4 Parts List

Item #	Value
LTS150C and LTS150C/M	Long Travel Stage with 150 mm travel
LTS300C and LTS300C/M	Long Travel Stage with 300 mm travel
LTS450C and LTS450C/M	Long Travel Stage with 450 mm travel
LTS600C and LTS600C/M	Long Travel Stage with 600 mm travel
LTSP1 and LTSP1/M	XY Mounting Adapter Plate
LTSP2 and LTSP2/M	Vertical (Z-axis) Mounting Plate for LTS150C
LTSP3 and LTSP3/M	Vertical (Z-axis) Mounting Plate for LTS300C
HA0203T	Handbook

1.5.5 Mechanical Drawings

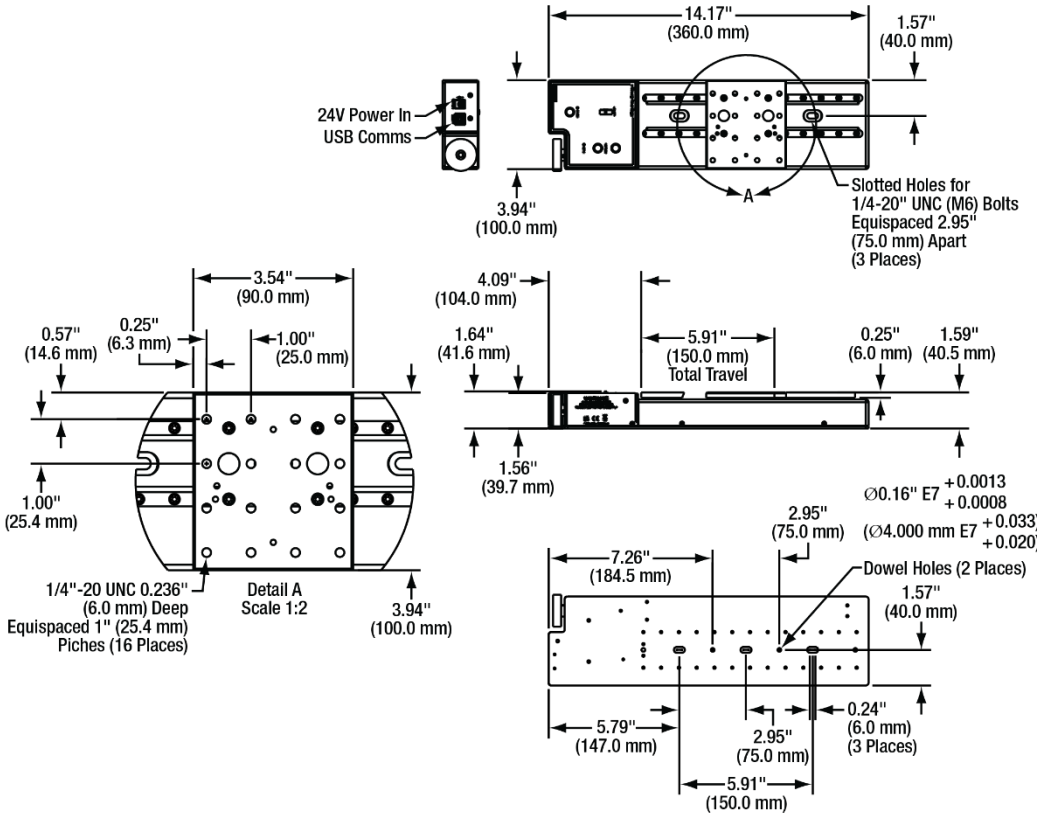


Figure 4 LTS150 Imperial Mechanical Drawing

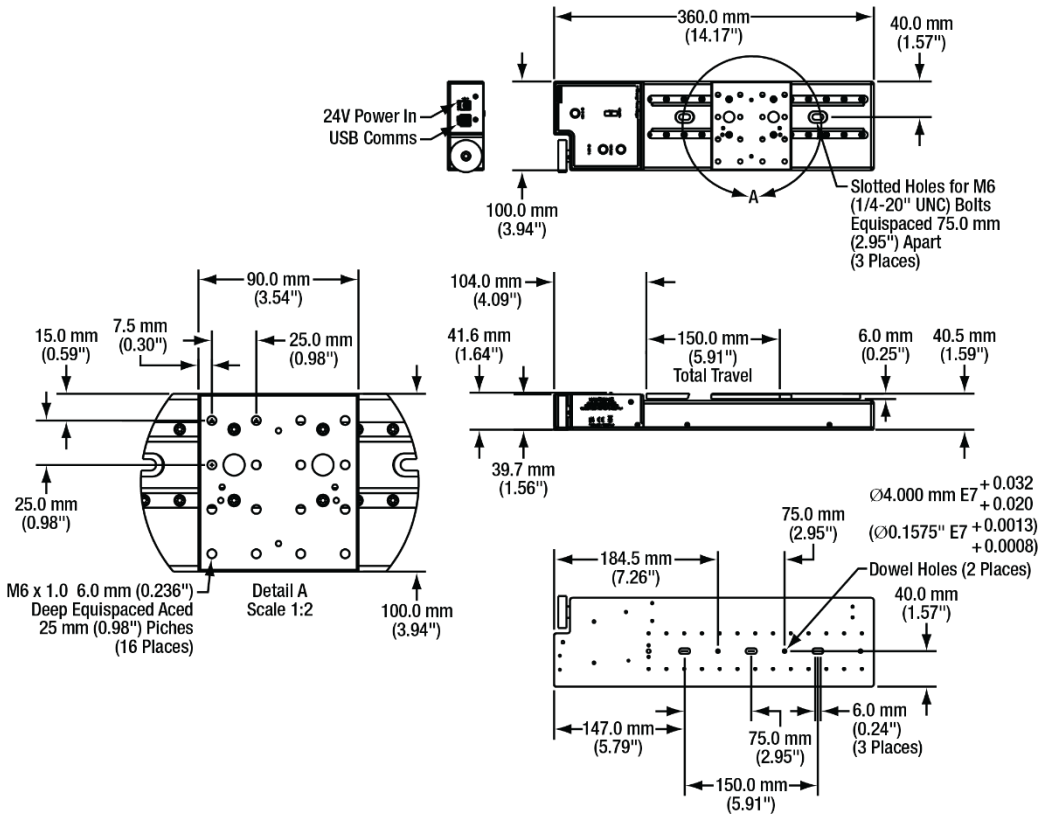


Figure 5 LTS150 Metric Mechanical Drawing

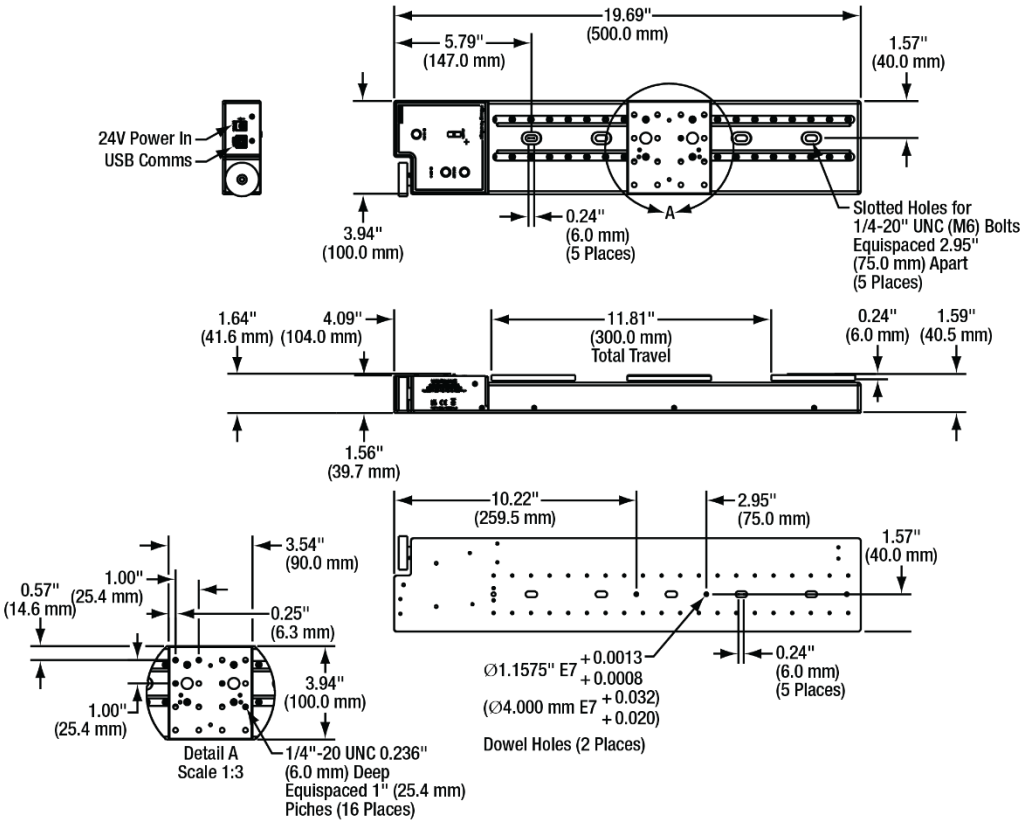


Figure 6 LTS300 Imperial Mechanical Drawing

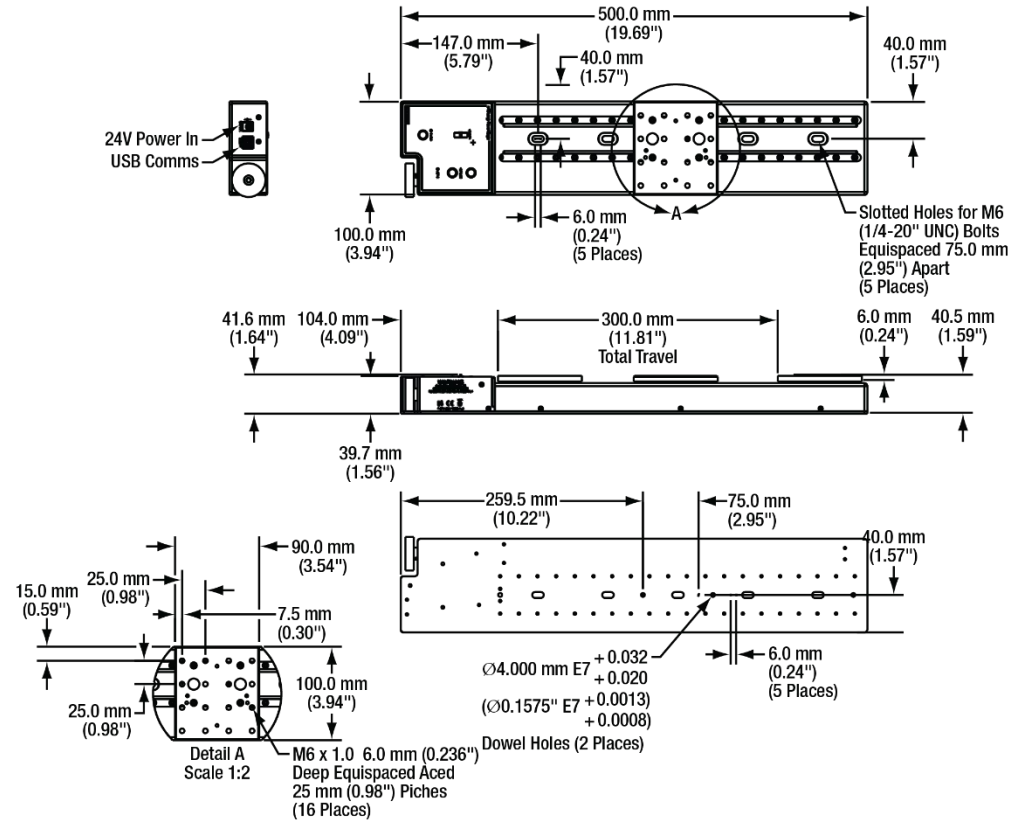


Figure 7 LTS300 Metric Mechanical Drawing

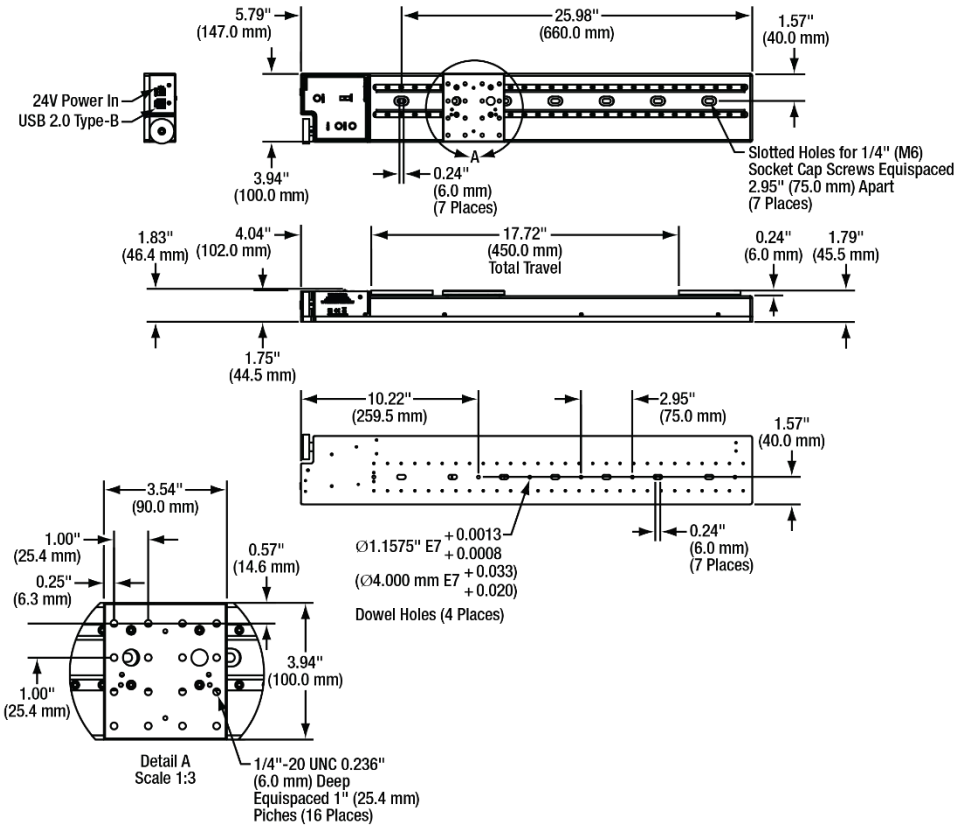


Figure 8 LTS450 Imperial Mechanical Drawing

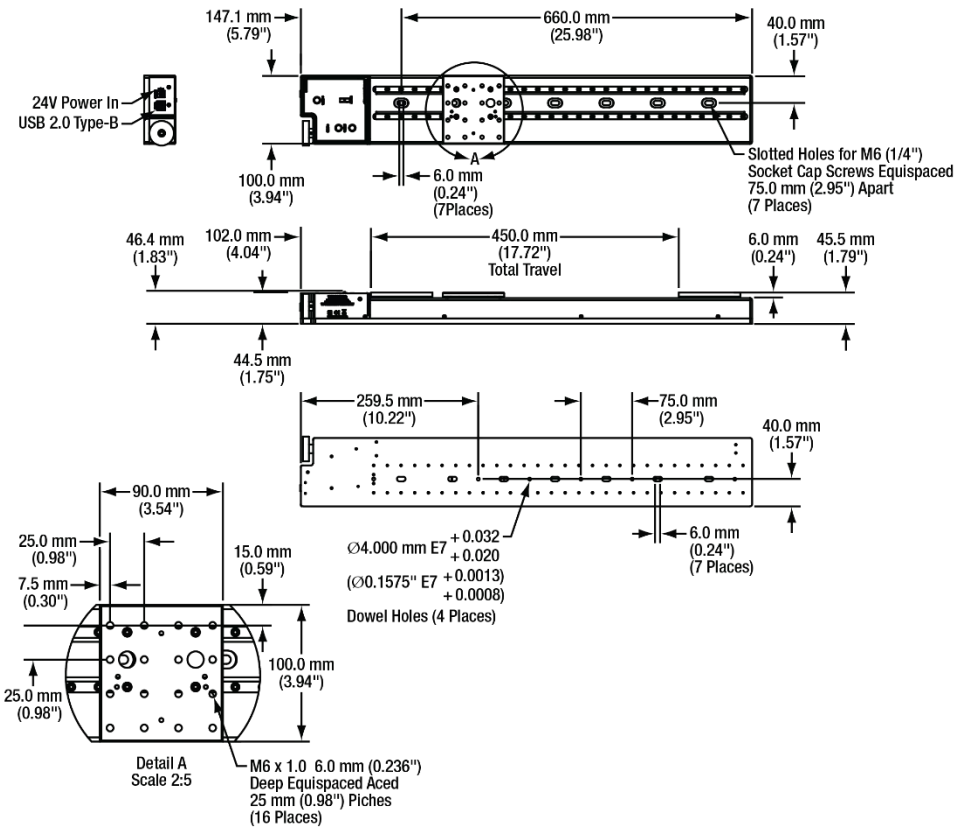


Figure 9 LTS450 Metric Mechanical Drawing

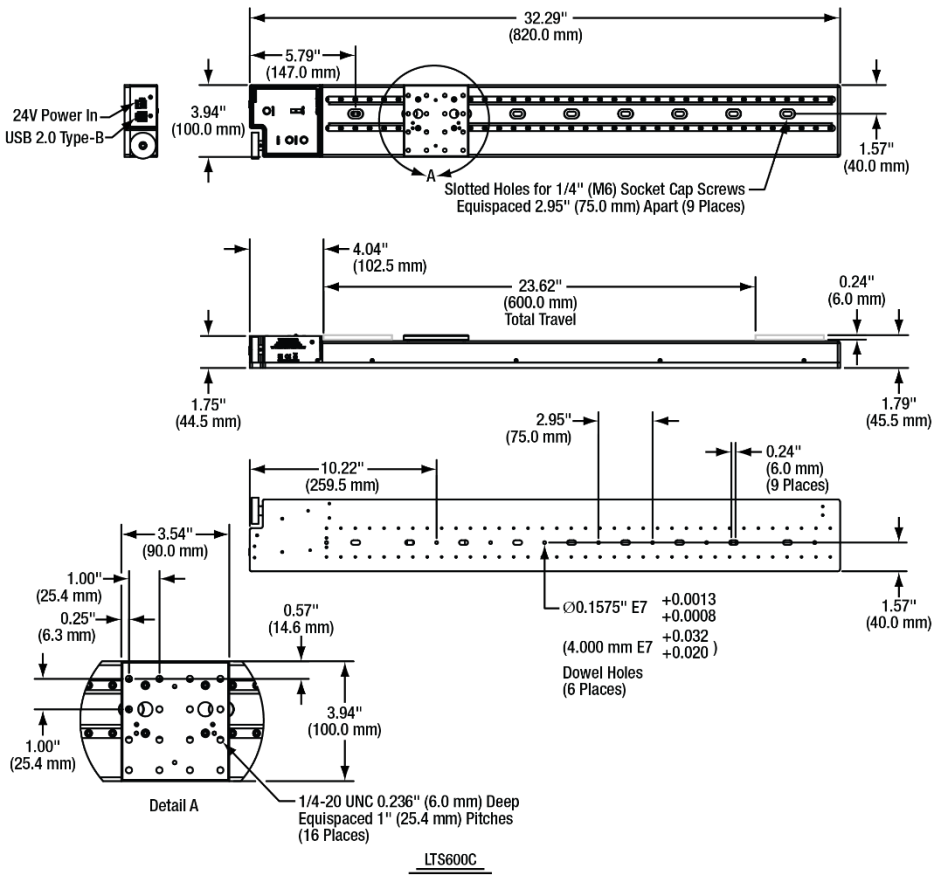


Figure 10 LTS600 Imperial Mechanical Drawing

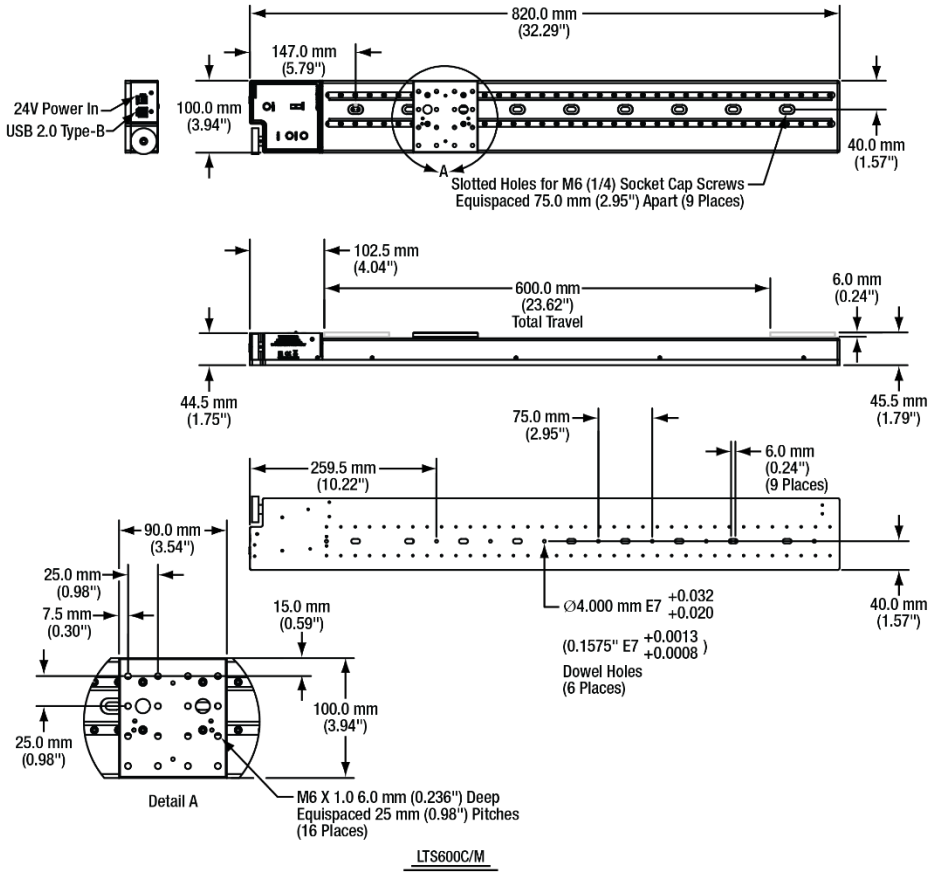
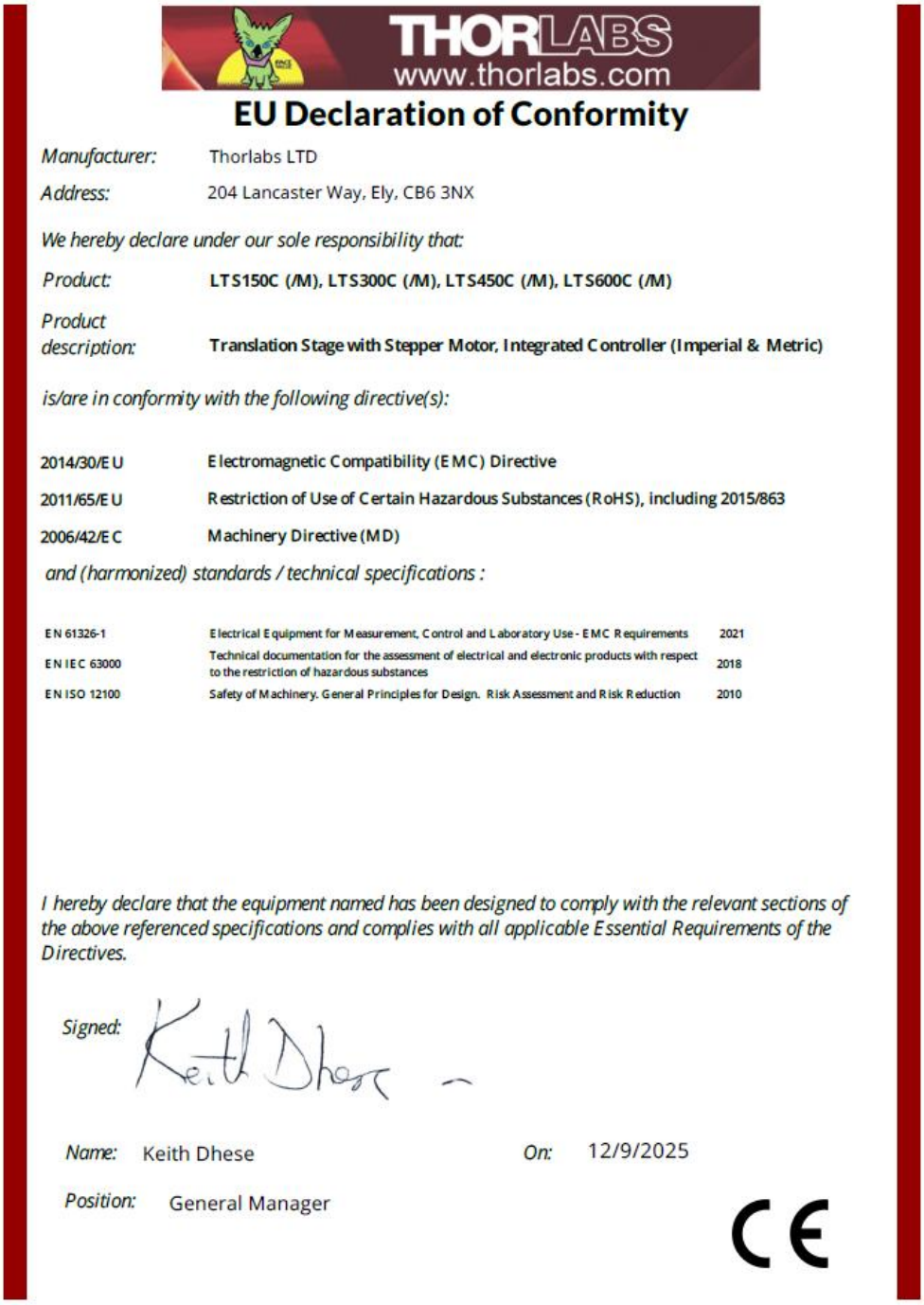


Figure 11 LTS600 Metric Mechanical Drawing

1.6 Simplified Declaration of Conformity



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: **LTS150C (/M), LTS300C (/M), LTS450C (/M), LTS600C (/M)**

Product description: **Translation Stage with Stepper Motor, Integrated Controller (Imperial & Metric)**

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	2021
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:* 12/9/2025

Position: General Manager

CE

1.7 FCC Designation

Class A FCC Designation

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.

Chapter 2 Safety

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.

NOTICE

Impairment of Operation and Damage to Equipment
If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Impairment of Operation and Damage to Equipment
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.

Indoor Usage Only
The equipment is for indoor use only

Damage to Equipment
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.

Damage to Equipment
The unit should not be exposed to corrosive agents, heat or dust.

Damage to Equipment
The unit is not designed to be used in explosive environments.

⚠CAUTION

Risk of Injury
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 3 Installation

NOTICE

Impairment of Operation and Damage to Equipment
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.

3.1 Warranty Information

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

3.2 Unpacking

NOTICE

Once removed from its packaging, the LTS stage is easily damaged by mishandling. The unit should only be handled by its base, not by the motor or any attachments to the moving platform.
Retain the packing in which the unit was shipped, for use in future transportation.

3.3 Mounting to a Work Surface

NOTICE

When siting the unit, it should be positioned so as not to impede the operation of the control panel buttons.
Make sure that proper airflow is maintained to the unit.
Remove power from the unit before bolting or unbolting from the work surface.
When mounting the LTS stage close to other 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 for each model is as follows:

- LTS150C: 150 mm
- LTS300C: 300 mm
- LTS450C: 450 mm
- LTS600C: 600 mm

Do the following:

1. Place the LTS stage in the required position on a flat surface.
2. Attach to the surface using the supplied 1/4-20 (M6) screws which fit through the base. The number of screws provided for each stage is as follows:

Stage	Number of Screws
LTS150C	3 (three)
LTS300C	5 (five)
LTS450C	7 (seven)
LTS600C	9 (nine)

NOTICE The mounting holes are accessed from the top of the stage.

NOTICE Sleeves are fitted in the moving platform to allow the bolts to pass through from the top surface (the mounting hole locations for the LTS300C are shown in Figure 12).

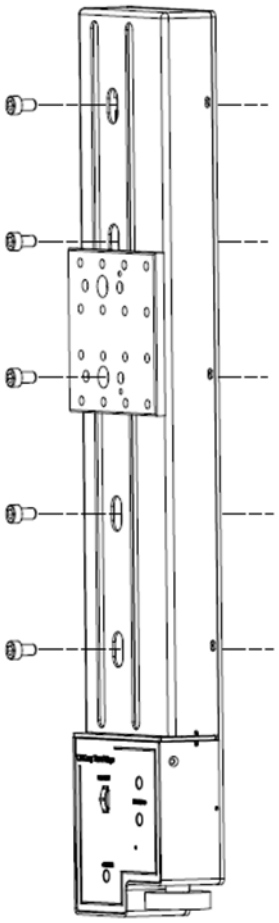


Figure 12 Mounting Hole Locations (LTS300C)

3.4 Mounting in a Multi-Axis Configuration

⚠CAUTION Make sure that any devices and components attached to the moving platform are securely fastened. Incorrectly attached components could come loose when the stage is operated.

The LTS series stages can be mounted in XY configurations using the LTSP1 spacer plate. The LTSP2 and LTSP3 angle brackets allow the LTS150C and LTS300C stages respectively to be mounted vertically in Z axis configurations.

NOTICE LTSP2 and LTSP3 angle brackets are **NOT** suitable for the LTS450C and LTS600C. To mount either the LTS450C and LTS600C vertically, bolt it to a sturdy upright bracket that has capacity to house all screws.
When mounted in a vertical (Z-axis) orientation, the maximum load capacity is 4 kg and the maximum velocity is 3 mm/sec.

For more information about installation with adaptor plates, refer to the documentation supplied with them.

⚠CAUTION For safety reasons, set the Max Vel parameter in the software **Settings** panel to 3 mm/sec – see Section 8.3.2. for more details.

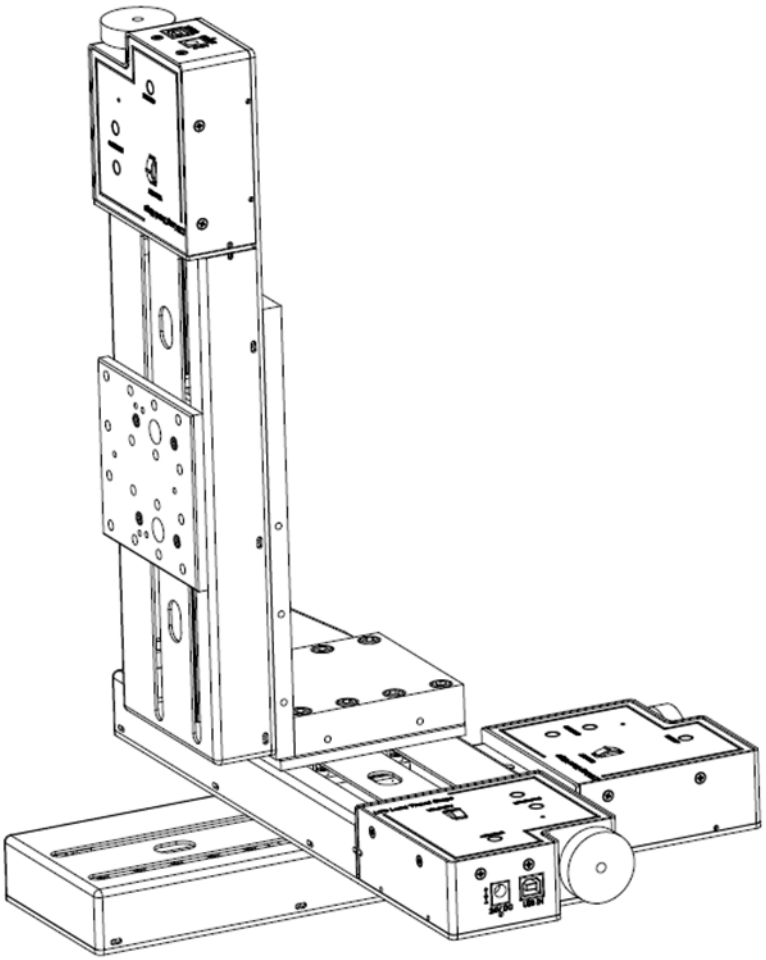


Figure 13 Typical XYZ Configuration (3 x LTS150Cs, LTSP1 and LTSP2)

3.5 Calibrating the Motor Drives

Calibration enables the server to correct for any mechanical errors inherent in the system. Mechanical components, such as the leadscrew and linkages, can be machined only within a certain tolerance, e.g., the leadscrew may be nominally 1 mm but actually 1.0005 mm, giving a 0.5 micron error. In practice, these errors accumulate from several sources, however they are repeatable and therefore, can be compensated.

During calibration, the total positional error is measured at many points and these errors are stored as a look up table (LUT). The LUT is saved as a calibration file, one file for each stage. The file is then linked to the appropriate stage using the Kinesis software. Whenever the stage is moved, the LUT is consulted to ascertain the precise movement required to achieve the demanded position.

The use of a calibration file is optional. Without it, the repeatability and resolution of the stage are unaffected, but no compensation is made to enhance the accuracy.

Calibration files can be downloaded from the support documents section on the product web page, one file for each serial number.

Details on assigning a calibration file are contained in Section 8.3.3.

3.6 Attaching Equipment and Devices

NOTICE

When attaching equipment or devices to the top platform, do not use bolts with a fixing thread longer than 6 mm (0.24”). Bolts of longer length protrude into the unit and could damage the internal mechanism.

3.7 Transporting the Unit

NOTICE

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.

3.8 Installing the Software

NOTICE

Some PCs may have been configured to restrict the user’s ability to load software, and on these systems the software may not install/run. If you are in any doubt about your rights to install/run software, please consult your system administrator before attempting to install.
If you experience any problems when installing software, contact Thorlabs on +44 (0)1353 654440 and ask for Technical Support.

NOTICE

Do not connect the stage to your PC yet.

1. Download the software from **www.thorlabs.com**.
2. Locate the downloaded **setup.exe** file and move to a suitable file location.
3. Open the **setup.exe** file and follow the on-screen instructions.

3.9 Connecting the Hardware

WARNING

Risk of electrical shock

The PSU unit must be connected only to an earthed fused supply of 90 - 264 VAC (47 - 63 Hz).

Use only the power supply supplied by Thorlabs, other units may not be rated to the same current.

The unit is shipped to the UK, Europe, and the USA, with the appropriate power plug already fitted. When shipped to other territories the appropriate power plug must be fitted by the user. Cable identification is as follows:

- Brown: Live
- Blue: Neutral
- Green/Yellow: Earth/Ground

When connecting the power and USB cables, ensure they are routed clear of the moving platform.

1. Make sure the mechanical installation as described in Sections 3.3 to 3.6 is complete.
2. Make sure the software has been installed according to the instructions in Section 3.8.
3. Connect one end of the supplied USB cable to the stage unit (see Figure 14).

NOTICE

If a communication length of more than 3 m is required, use a powered USB hub.

4. Connect the other end of the USB cable to the PC.
5. Connect the stage unit to the power supply.
6. Connect the PSU to the mains power outlet and switch on.
7. Wait for the unit to initialize (about 5 s). Do not press any controls during this time. The ENABLE LED is lit when the unit is ready for use.
8. Wait until Windows® installs the drivers for the new hardware.

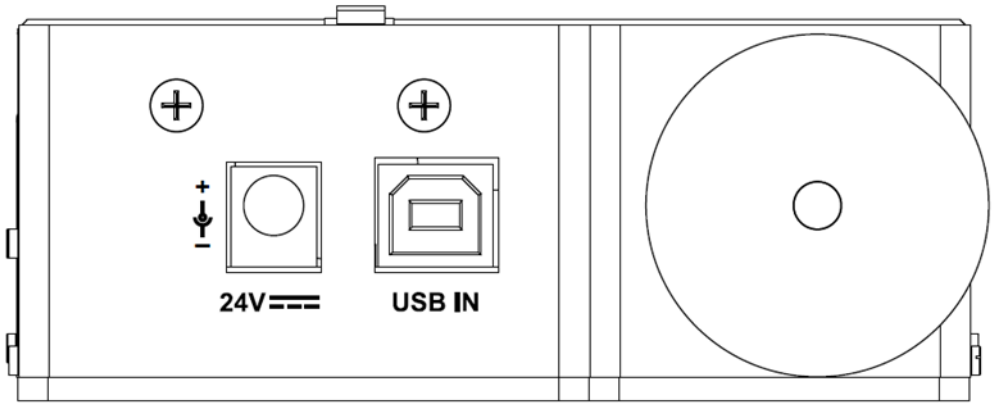


Figure 14 Power and USB Connectors