



KCH301 and KCH601 K-Cube and T-Cube USB Controller Hub and Power Supply

User Guide



Contents

Chapter 1 For Your Safety	3
1.1 <i>Safety Information</i>	3
1.2 <i>General Warnings</i>	4
Chapter 2 Overview and Setup	4
2.1 <i>Introduction</i>	4
2.2 <i>Mechanical Installation</i>	5
2.3 <i>Electrical Installation</i>	8
2.4 <i>Using Legacy T-Cubes</i>	11
 Appendices	
 Appendix A Connector Pinout Details	 14
Appendix B Preventive Maintenance	15
Appendix C Specifications	16
Appendix D Regulatory	17
Appendix E Thorlabs Worldwide Contacts	21

Chapter 1 For Your 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 absorbant tissue. Do not allow spilled fluid to enter the internal mechanism.

 **Caution** 
If your PC becomes unresponsive (e.g due to an operating system problem, entering a sleep state condition, or screen saver operation) for a prolonged period, this will interrupt communication between the APT Software and the hardware, and a communications error may be generated. To minimize the possibility of this happening it is strongly recommended that any such modes that result in prolonged unresponsiveness be disabled before the APT software is run. Please consult your system administrator or contact Thorlabs technical support for more details.

Chapter 2 Overview and Setup

2.1 Introduction

The K-Cube Controller Hubs have been designed specifically with multiple K-Cube operation in mind, in order to simplify issues such as cable management, power supply routing, multiple USB device communications and different optical table mounting scenarios.

The K-Cube Controller Hub is available with either three (KCH301) or six (KCH601) bays. It comprises a slim base-plate type carrier with electrical connections located on the upper surface to accept the K-Cubes. Mix and match any combination of K-Cube Controllers to build your own custom multi-channel driver arrangement in an extremely compact footprint.

Internally the Controller Hub contains a fully compliant USB 2.0 hub circuit to provide communications for all the K-Cubes – a single USB connection to the Controller Hub is all that is required for PC control. The Controller Hub also provides power distribution for the K-Cubes and again requires only a single power connection. This USB and power routing capability vastly reduces the number of USB and power cables required when operating multiple K-Cubes. Furthermore, a USB output connector can be connected to the USB input on another Hub allowing multiple Controller Hubs to be connected together while still only requiring a single USB cable from the host control PC.

The Controller Hub circuitry also provides a number of internal flexible digital and analogue interconnect lines for deterministic multiple-cube synchronised operation.



Fig. 2.1 KCH301 3-Channel USB Controller Hub (PSU not shown)

The Controller Hub provides a rigid mechanical mounting platform for carrying the K-Cubes. Mounting holes incorporated in the Hub allow for a variety of mounting orientations. In this way the Controller Hub can be mounted flat to the table surface (much like the individual K-Cubes), or vertically mounted to allow vertical stacking of the K-Cube controllers, thereby reducing optical table footprint to an absolute minimum. In addition, the underside of the bottom face includes magnets (two for KCH301, three for KCH601) for secure but temporary fixing.

An adapter plate KAP101 is available to allow legacy T-cube series units to be fitted to the K-Cube hub - see Section 2.4. for more details.



Fig. 2.2 KAP101 T-Cube Adapter Plate

2.2 Mechanical Installation

2.2.1 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 to 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.

2.2.2 Mounting Options

The K-Cube Controller Hub is shipped complete with attachment brackets for horizontal orientation, ready to be bolted to a breadboard, optical table or similar surface - see Section 2.2.3.

If required, Thorlabs AP90 Angle Brackets can be used to mount the hub vertically - see Section 2.2.4.



Caution



When siting the hub, it should be positioned so as not to impede the operation of the control panel buttons on the K-Cube Controllers. Ensure that proper airflow is maintained to all units fitted to the hub.

2.2.3 Flat Mounting

- 1) Remove any K-Cube units fitted to the hub.
- 2) Turn the hub upside down and remove any attachment brackets previously fitted.
- 3) Fit the flat brackets (supplied) to the back face of the hub, using the four M4 x 8 mm screws supplied - see Fig. 2.3



Fig. 2.3 Fitting the Brackets for Flat Mounting

- 4) Position the hub in the desired position on the worksurface.
- 5) Line up the attachment holes in the bracket and the worksurface, then fit the bolts (not supplied) to secure the assembly in position - see Fig. 2.4.

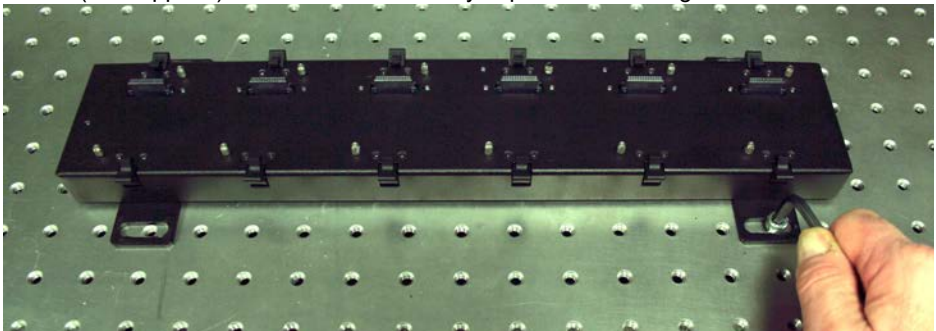


Fig. 2.4 Bolting the Assembly to The Worksurface

- 6) Populate the hub with K-Cubes as required.

2.2.4 Vertical Mounting

- 1) Remove any K-Cube units fitted to the hub.
- 2) Turn the hub upside down and remove any attachment brackets previously fitted.
- 3) Using four M6 bolts (not supplied), fit the AP90 Angle bracket to the back face of the hub - see Fig. 2.5



Fig. 2.5 Fitting the AP90 Bracket for Vertical Mounting

- 4) Position the hub in the desired position on the worksurface.
- 5) Line up the attachment holes in the bracket and the worksurface, then fit the bolts to secure the assembly in a vertical position - see Fig. 2.6.

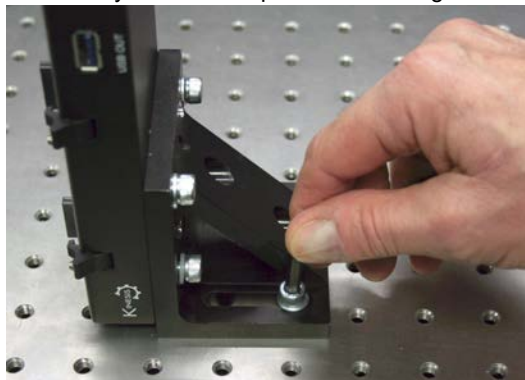


Fig. 2.6 Bolting the Assembly to The Worksurface

- 6) Populate the hub with K-Cubes as required.

2.3 Electrical Installation

2.3.1 Hub Supply voltage and current requirements

Supply	Minimum	Maximum	Max Operating Current
15 V	14 V	16 V	10 A

2.3.2 Connecting To A Power Supply Unit

Warning

The hub must be connected only to the power supply shipped with the unit. Connection to a supply of a different rating may cause damage to the unit and could result in injury to the operator.

Caution

Do not connect the hub to a 'live' external power supply. Doing so (i.e. "hot plugging") carries the risk of PERMANENT damage to the unit. Always ensure the power supply unit is isolated from the mains before connecting to the hub. Always power up the hub by connecting its power supply to the mains. Similarly, to power down the unit, disconnect the power supply from the mains before disconnecting the hub.

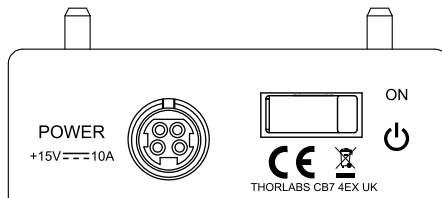


Fig. 2.7 Power Supply Connections

POWER - 15 V, 10A input from power supply provided.

ON Switch - Switches the power on and off.

- 1) Connect the PSU supplied to the hub as detailed in section .
- 2) Switch on the Power Supply unit.

2.3.3 Hub IO Connections

The hub is fitted with input and output connections as described below.

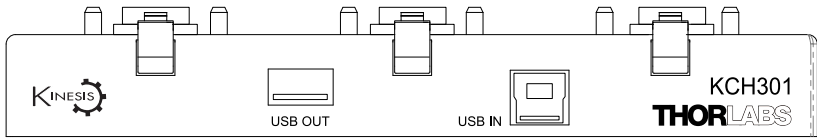


Fig. 2.8 USB IN, USB OUT Connections

USB IN - provides communication to the host controller PC.

USB OUT - can be connected to the USB IN on another Hub or other USB device, allowing multiple Controller Hubs to be connected together, thereby requiring only a single USB cable from the host control PC.



Caution



K-Cube Hub Signal Routing.

The K-Cube Hub allows the transfer of voltage signals between K-Cubes with two available analog lines. This is used by the KPZ101 Piezo Cube and TSG001 Strain Gauge Cube to route a feedback signal via the Hub for closed loop operation. It is also used by the TNA001 NanoTrak Cube to send position demand signals to a pair of slave TPZ001 Piezo Cubes.

A clash can occur if a TSG001 Strain Gauge Cube and a TNA001 NanoTrak Cube are combined on the hub, and both attempt to drive voltage signals out via the Hub. In this instance it is recommended that the TNA001 NanoTrak Cube is configured to drive signals out via its SMA connections and the associated KPZ101 Piezo Cube pair configured to pick these signal up via SMA inputs. This will require small SMA to SMA connection cables, various lengths of which are available from Thorlabs.

2.3.4 Fitting a K-Cube Driver Unit

Warnings

DO NOT PLUG A K-Cube INTO A POWERED UP KCHx01 USB CONTROLLER HUB. Always ensure that all power is disconnected from the K-Cube driver unit AND the hub before the K-Cube is plugged in. Failure to observe this precaution will seriously damage the K-Cube unit and could result in personal injury.

NEVER POWER A K-Cube USING ITS LOCAL POWER SOCKET WHEN IT IS ALSO PLUGGED INTO THE CONTROLLER HUB. Dual powering a K-Cube in this way will result in severe damage to the K-Cube unit and could result in personal injury



Fig. 2.9 Fitting A K-Cube Driver Unit

- 1) Ensure that all power is disconnected from the hub AND the K-Cube unit to be fitted.
- 2) Remove the plastic cover from the relevant connector
- 3) Undo the plastic securing clips on each side of the hub at the position to be fitted.
- 4) Check for correct orientation of the ERNI connector socket on the hub and its mating plug on the K-Cube unit, (the cube front panel featuring the ON switch and part number always faces the Kinesis® and Thorlabs logos) then plug the K-Cube unit into the hub, ensuring that the locating pegs are correctly fitted into the lugs on the K-Cube.
- 5) Do up the securing clip.

Caution

To prevent the ingress of dust and moisture, ensure that the ERNI connector covers remain fitted to any unpopulated K-Cube bays.

2.4 Using Legacy T-Cubes

An adapter plate (KAP101) is available separately which allows existing T-Cubes to be fitted easily to the KCH series hubs.



- 1) Ensure that all power is disconnected from the hub.
- 2) Remove the plastic cover from the relevant connector.
- 3) Undo the plastic securing clips on each side of the hub at the position to be fitted.
- 4) Check for correct orientation of the ERNI connector socket on the hub and its mating plug on the adapter plate, then plug the adapter plate into the hub, ensuring that the locating pegs on the hub are correctly fitted into the lugs on the K-Cube.
- 5) Do up the securing clip.
- 6) If fitted, remove the base plate from the T-Cube, retain the screws for later use.
- 7) Check for correct orientation of the ERNI connector socket on the KAP101 adapter plate and its mating plug on the T-Cube unit, then plug the T-Cube unit into the hub, ensuring that the locating pegs on the adapter plate are correctly fitted into the lugs on the T-Cube.
- 8) Using the screws retained at item (6) secure the T-Cube to the adapter plate.



Fig. 2.10 KCH601 Loaded with K-Cubes and T-Cubes

2.4.1 Hub Mounting Options.

When the K-Cubes are used on the hub, signals can be routed via dedicated internal communication channels. These channels are selected via the associated K-Cube unit settings panel, or via the 'MENU' button on the top panel of the unit.

If *Channel 1* is selected, the feedback signal runs through all the bays - see Fig. 2.11. If *Channel 2* is selected, the feedback signals run between adjacent pairs of K-Cube bays (i.e. 1 and 2, 3 and 4, 5 and 6) - see Fig. 2.11.

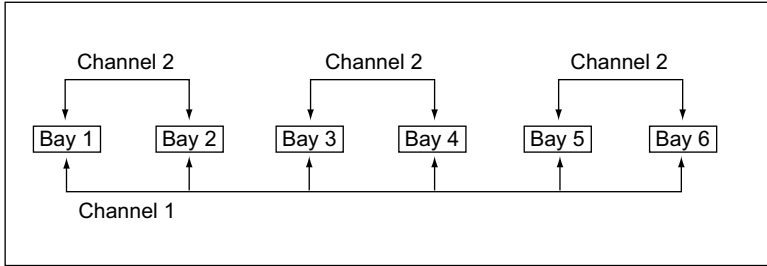


Fig. 2.11 Hub Analog Input Channels

Only certain K-Cube arrangements allow the system to function correctly. Furthermore, the setting for the *Analogue Input Source (EXT IN)* parameter in the piezo settings panel, depends on the bays in which the K-Cube units are fitted. The various bay options, and their associated *Analogue Input Source (EXT IN)* settings are described in Fig. 2.12.



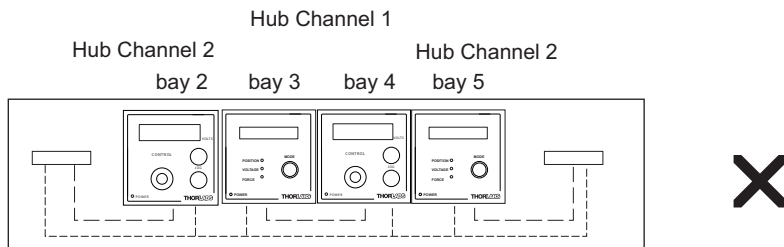
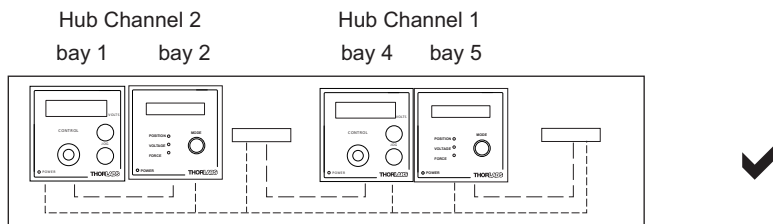
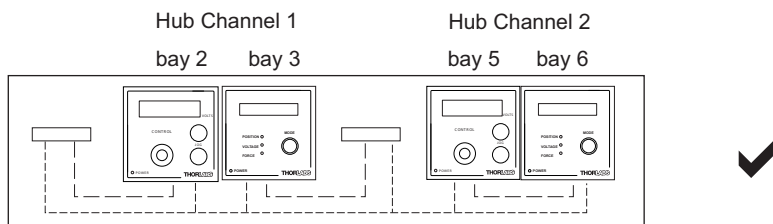
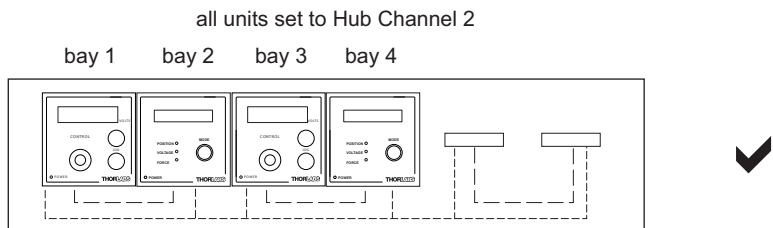
Caution



In general, when members of the K-Cube family are on the KCHx01 controller hub, using the signal channels (Channel 1 and Channel 2), users must ensure that:

The individual cubes are set up to use the intended signal channel.

Only one cube is driving the intended signal channel.



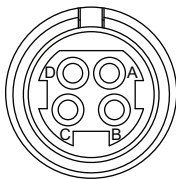
This combination will not work

Fig. 2.12 Bay Options and Associated Analog Input Source Settings

Appendix A Connector Pinout Details

A.1 Power Connector

A flying lead terminated in a circular, 4-pin plug provides connection to the power supply. The pin functions and supply requirements are detailed in Fig. A.1.



Pin	Description	Minimum	Maximum	Max Operating Current
A	15 V	14 V	16 V	10 A
B	15 V Return	-	-	-
C	15 V Return	-	-	-
D	15 V	14 V	16 V	10 A

Note. Pins A and D, and B and C are shorted together internally

Fig. A.1 POWER Connector Pin Identification

Appendix B Preventive Maintenance



Warning



The equipment contains no user servicable parts. There is a risk of 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 remove its covers or attempt any repairs or adjustments. Maintenance is limited to safety testing and cleaning as described in the following sections.

B.1 Safety Testing

PAT testing of the power supply unit in accordance with local regulations, should be performed on a regular basis, (typically annually for an instrument in daily use).

B.2 Cleaning



Warnings



Disconnect the power supply before cleaning the unit.
Use only a soft, dry cloth to dust the outside faces.
Do not use any water, detergents, solvents or other liquids.
Do not use any type of abrasive pad or scouring powder.

Appendix C Specifications

C.1 Specifications

USB Hub Circuit: Fully Compliant USB 2.0 Hub

Enclosure: Rigid Slim Profile 'Baseplate' Construction

Finish: Black

K-Cube Bays: three or Six

Table Mounting Orientation: Horizontal, or Vertical using Thorlabs AP90 Bracket

Table Mounting Fixings: Universal Metric (M6) or Imperial (1/4"-20) Design

Power Lines: 15 V, 10 A

Mains Power: Voltage: 85-264 V AC
 Power: 150 VA

Appendix D Regulatory

D.1 Declarations Of Conformity

D.1.1 For Customers in Europe
See Section D.3.

D.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.

D.2 Waste Electrical and Electronic Equipment (WEEE) Directive

D.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. 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. 4.1 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.

D.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.




D.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.

D.3 CE Certificate

	THORLABS www.thorlabs.com	
EU Declaration of Conformity <i>in accordance with EN ISO 17050-1:2010</i>		
We:	Thorlabs Ltd.	
Of:	1 St. Thomas Place, Ely, CB7 4EX, United Kingdom	
<i>in accordance with the following Directive(s):</i>		
2006/95/EC	Low Voltage Directive (LVD)	
2004/108/EC	Electromagnetic Compatibility (EMC) Directive	
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)	
 <i>hereby declare that:</i>		
Model:	KCH601	
Equipment:	6 Port K-Cube Hub	
 <i>is in conformity with the applicable requirements of the following documents:</i>		
EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EC No 278/2009	Eco-Design Requirements for External Power Supplies	2009
 <i>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:</i>		
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>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.</i>		
Signed:		On: 01 February 2016
Name:	Keith Dhese	CE 16
Position:	General Manager	
		EDC - KCH601 -2016-02-01

		<h1>THORLABS</h1> <p>www.thorlabs.com</p>	
<h2>EU Declaration of Conformity</h2> <p><i>in accordance with EN ISO 17050-1:2010</i></p>			
We:	Thorlabs Ltd.		
Of:	1 St. Thomas Place, Ely, CB7 4EX, United Kingdom		
<i>in accordance with the following Directive(s):</i>			
2006/95/EC	Low Voltage Directive (LVD)		
2004/108/EC	Electromagnetic Compatibility (EMC) Directive		
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)		
<i>hereby declare that:</i>			
Model:	KCH301		
Equipment:	3 Port K-Cube Hub		
<i>is in conformity with the applicable requirements of the following documents:</i>			
EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.		2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements		2013
EC No 278/2009	Eco-Design Requirements for External Power Supplies		2009
 <i>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:</i>			
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>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.</i>			
Signed:		On:	01 February 2016
Name:	Keith Dhese		
Position:	General Manager	EDC - KCH601 - 2016-02-01	

Appendix E 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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