THORLABS

MTS25 and MTS50 Series
Motorized Translation Stages

User Guide

Contents

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.

Chapter 2 Overview

2.1 Introduction

The compact, motorized MTS Series stages feature a dual set of linear rails with continuously recirculating ball bearings on a moveable carriage. This mechanism provides smooth, low friction movement and ensures high load capacity.

The drive power is provided by a DC servo motor. A built-in optical encoder provides 12,288 counts per revolution resulting in a minimum incremental motion of less than 50nm.

The addition of limit switches on the stage itself ensures controlled motion within the parameters of the unit and prevents overdriving in both directions. Two travel ranges are available: 1" (25mm) and 2" (50mm). The stages are configurable in XY, XZ, and XYZ in both left- and right-handed configurations using spacer plates (MTS25B-Z8 and MTS50B-Z8) and angle brackets (MTS25C-Z8 and MTS50C-Z8) available separately). Base plates (MTS25A-Z8 and MTS50A-Z8) allow the stages to be bolted directly to an optical table. For added flexibility, both sizes of travel stages can be configured together.

For attachment to other stages or fittings, please contact Tech Support..

Fig. 2.1 Typical MTS stage and driver set up

Chapter 3 Installation

Note

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

Caution

Once removed from its packaging, the stage can be damaged by mishandling. The unit should only be handled by the base, not by the top platform or any mounted accessories.

3.1 Mounting

3.1.1 General

The MTS series stages can be mounted horizontally or vertically using the base plates, spacer plates and angle brackets previously mentioned - see Section 2.1. When mounting the 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 is: MTS25 stages: 25mm, MTS50 stages: 50mm

Caution

The stages are set up and calibrated at the factory and no further adjustment is necessary.

Do not allow screws or other objects to protrude through the top platform as this could damage the internal mechanism.

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

Note

The MTS series stages can quickly be assembled into XY, XZ, YZ and XYZ configurations - see Section 3.1.4. and Section 3.1.5. The brackets and plates are supplied complete with dowels, which ensure an accurate, orthogonal assembly, and all bolts.

3.1.2 Connecting The Motor Driver

Caution

It is recommended that the MTS series stages be driven by the Thorlabs TDC001 DC Servo Motor Driver. If the stage is being driven by any other driver or controller, consult Section A.1. for motor pin out details and Chapter 5 for details of the motor specification.

The stage is supplied with 0.5m (1.6 ft) of cable and is terminated in a 15 pin D-Type connector. This is compatible with the MOTOR drive terminal of the TDC001 T-Cube DC driver unit - see Fig. 3.1 below. A 3m (9.8 ft) extension cable (PAA632) is available on request.

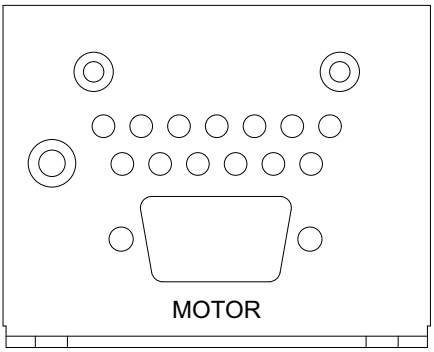


Fig. 3.1 TDC001 rear panel

3.1.3 Fitting and Removing the Base Plate

Referring to Fig. 3.2, proceed as follows:

1) Fit the dowels supplied to the base plate (MTS25A-Z8 or MTS50A-Z8).
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 the four bolts supplied M3 x 10 (4-40 x 1/2") through the holes in the underside of the base plate, and tighten to secure the stage in place.

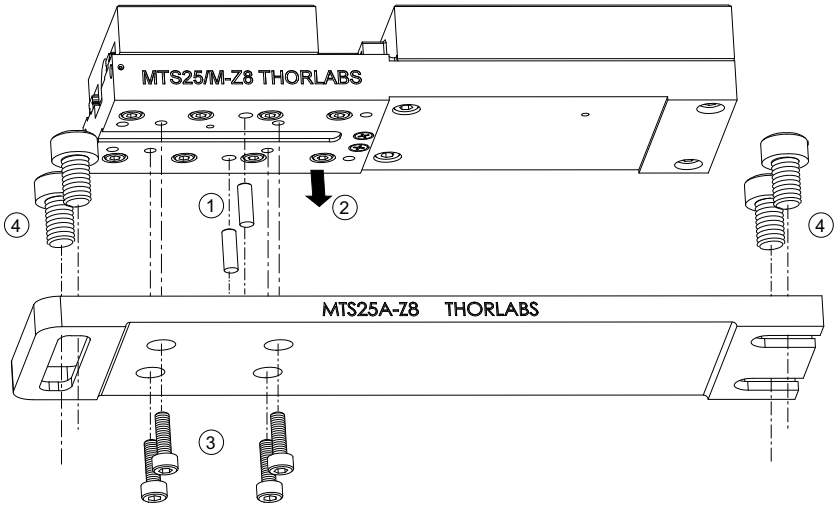


Fig. 3.2 Fitting the MTS25A-Z8 Base Plate

4) Fit two of the bolts supplied M6 x 10 (1/4-20 x 3/8") 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.

3.1.4 Building an XY Configuration

Referring to Fig. 3.3, proceed as follows:

1) Fit the dowels supplied to the moving platform of the lower stage.
2) Note the orientation of the spacer plate in the drawing below, then fit the spacer plate (MTS25B-Z8 or MTS50B-Z8) to the moving platform of the lower stage, ensuring that the dowels locate correctly in the holes and protrude through the top surface of the spacer plate.
3) Fit the four bolts supplied M3 x 6 (4-40 x 1/4”), through the holes in the spacer plate, and tighten to secure the plate in place.
4) Fit the Y-axis stage into place ensuring that the dowels in the spacer plate locate correctly in the holes in the lower surface of the stage..

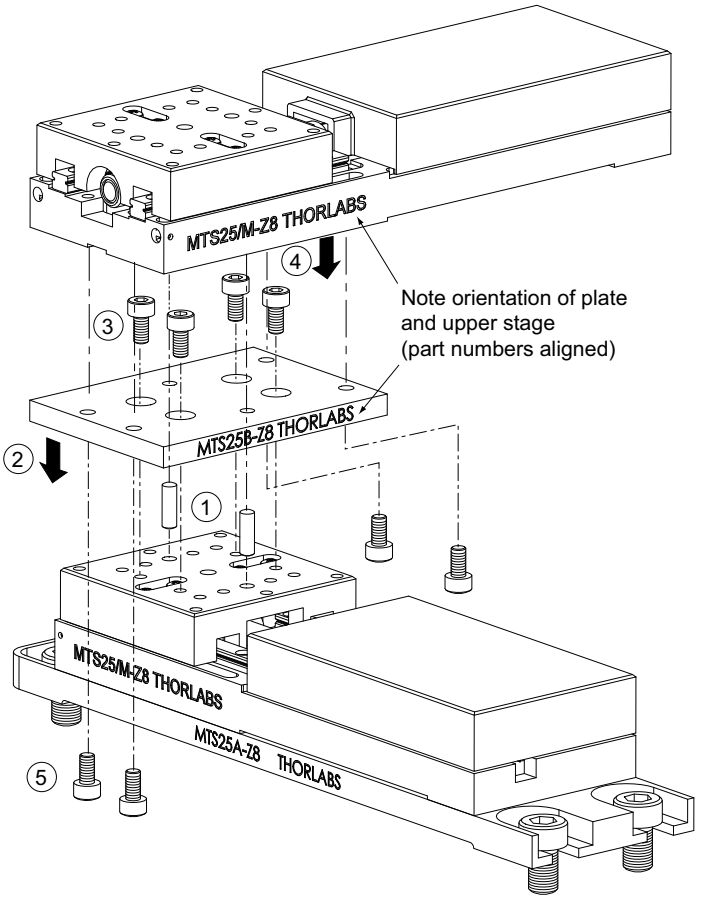


Fig. 3.3 Building an XY Configuration

5) Fit the four bolts supplied M3 x 6 (4-40 x 1/4”) through the holes in the underside of the spacer plate and screw into the base of the upper stage.
6) Tighten the bolts to secure the stage in place.
7) Fit the base plate to the X-axis (lower) stage, and bolt the assembly to the worksurface as detailed in Section 3.1.3.

3.1.5 Building an XYZ Configuration

Assemble an XY configuration as detailed in Section 3.1.4. then, referring to Fig. 3.4, proceed as follows:

1) Fit the dowels supplied to the moving platform on the upper stage of the XY assembly.
2) Fit the angle bracket (MTS25C-Z8 or MTS50C-Z8) 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..

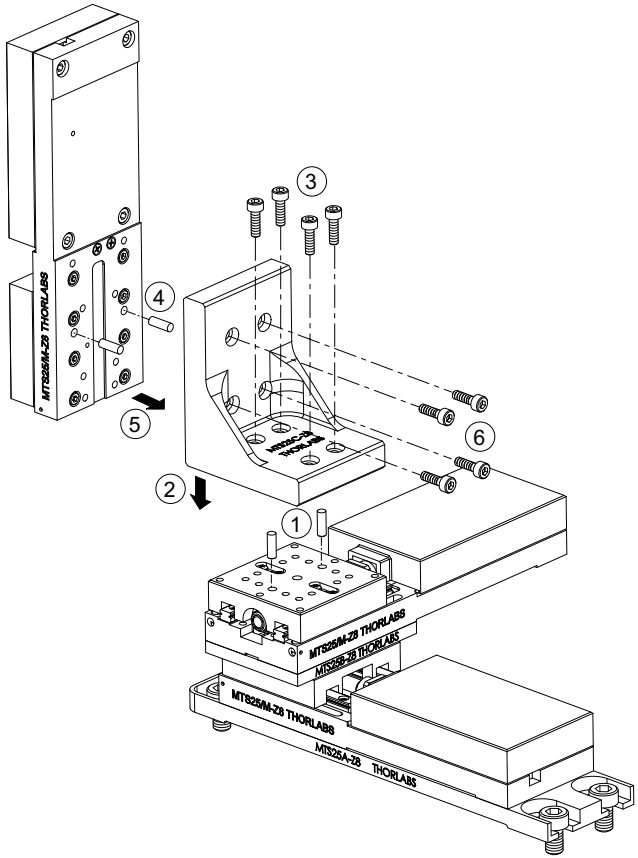


Fig. 3.4 Adding a Vertical Axis Stage

3) Fit the four bolts supplied M3 x 10 (4-40 x 1/2”), 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 four bolts supplied M3 x 10 (4-40 x 1/2”), through the holes in the angle bracket, and screw into the base of the vertical-axis stage.
7) Tighten the bolts to secure the stage in place.
8) Fit the base plate to the X-axis (lower) stage, and bolt the assembly to the worksurface as detailed in Section 3.1.3.

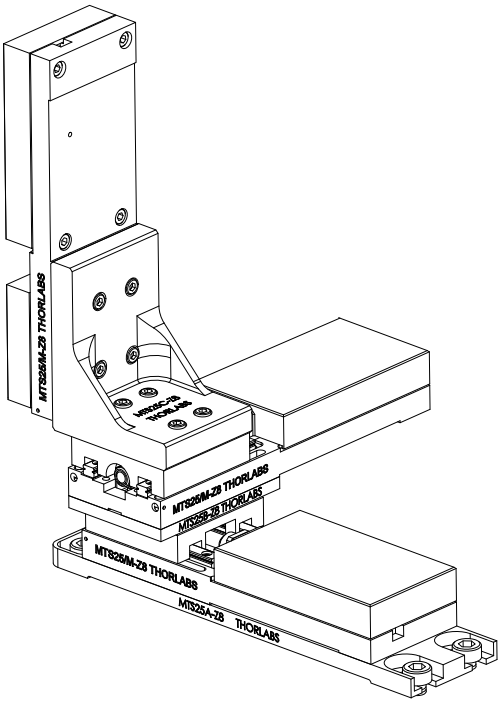


Fig. 3.5 Typical XYZ configuration

3.2 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.

3.3 Dimensions

3.3.1 MTS Dimensions

all dimensions in inches (mm)

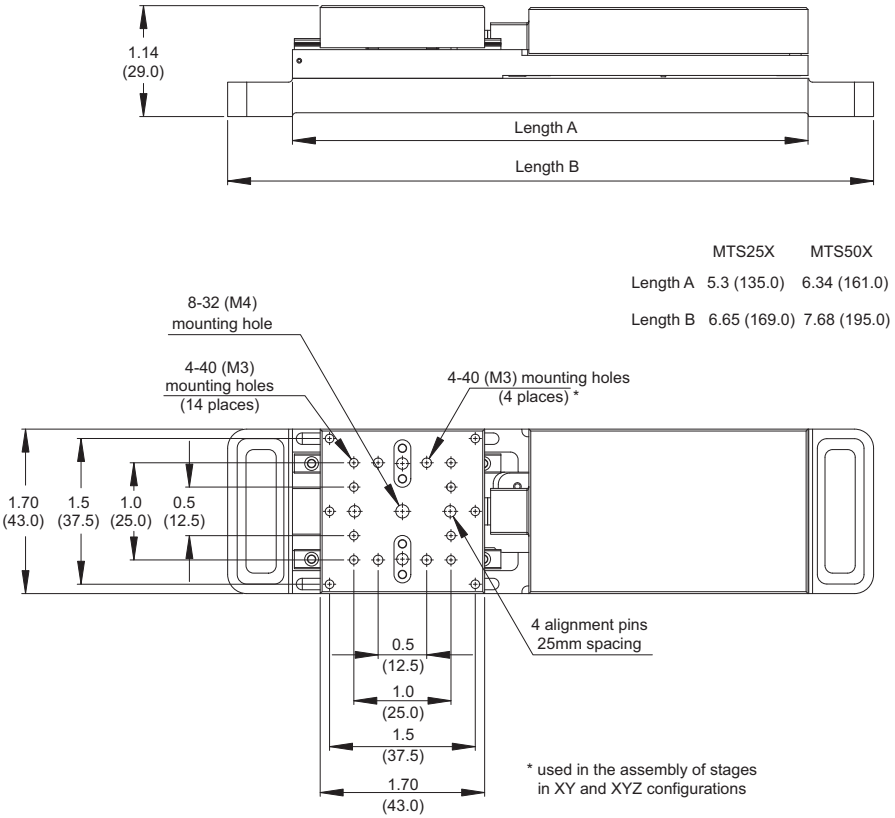


Fig. 3.6 Dimensions

Caution

The stages are set up and calibrated at the factory and no further adjustment is necessary. Do not allow screws or other objects to protrude through the top platform as this could damage the internal mechanism.

Chapter 4 Operation

4.1 General

Caution

The MTS series stages form part of the Thorlabs Nanopositioning system. We recommend they are driven by the Thorlabs TDC001 T-Cube DC Servo Motor Driver. If the stage is being driven by any other driver or controller, consult Section A.1. for motor pin out details and Chapter 5 for details of the motor specification.

Caution

The stages are set up and calibrated at the factory and no further adjustment is necessary. Do not allow screws or other objects to protrude through the top platform as this could damage the internal mechanism.

The stages are connected to the controller via a flying lead terminated in a D-type connector.

Warning

The controller must be switched OFF before the stages are plugged in or unplugged. Failure to switch the controller off may result in damage to either the controller, the stage, or both.

For a complete tutorial on using the stage with a motor controller, see the relevant controller manual. Basic steps in controlling the stage are as follows:

1) Perform the mechanical installation as detailed in Section 3.1.
2) Connect the stage to the DC motor driver - see Section 3.1.2.
3) Connect the driver to the main supply and switch ‘ON’.
4) Connect the driver unit to your PC.

Note

The USB cable should be no more than 3 metres in length. Communication lengths in excess of 3 metres can be achieved by using a powered USB hub).

5) Start the APTUser utility - Start/Programs/Thorlabs/APT User/APT User
The APT server reads in the stage and controller information on boot up and the settings made above are displayed in the 'Setting' window as shown in Fig. 4.1.

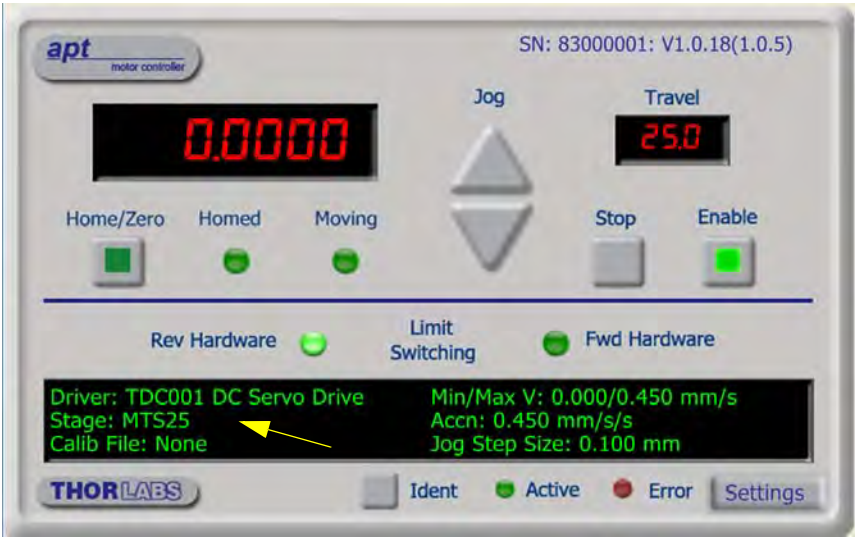


Fig. 4.1 APTUser GUI screen

6) Move the stage to its home position, to establish a zero datum - see the handbook supplied with the TDC001 driver unit.

See the APTConfig and APTUser online help files for further information on the use of these utilities.

Chapter 5 Specifications

5.1 Stage Specifications

Parameter	Value
Bidirectional Repeatability	1.6 µm
Backlash	<6 µm
Maximum Acceleration	4.5 mm/sec2
Maximum Velocity	3.0 mm/sec
Velocity Stability	± 0.25 mm/sec
Max Vertical On-Axis Load Capacity	4.5 kg (10 lb)
Max Horizontal On-Axis Load Capacity	12 kg (25 lb)
Recommended Vertical Load Capacity	4 kg (8.8 lb) (Continuous Use)
Recommended Horizontal Load Capacity	10 kg (22 lb) (Continuous Use)
Min Acheivable Incremental Movement	0.05 µm
Min Repeatable Incremental Movement	0.5 µm
Absolute On-axis Accuracy	MTS25 145 µm MTS50 290 µm
Maximum Percentage Accuracy	MTS25 0.3% MTS50 0.7%
Home Location Accuracy	± 4.0 µm
Pitch	MTS25 0.04° MTS50 0.05°
Yaw	MTS25 0.05° MTS50 0.06°
Weight	MTS25 0.31 kg MTS50 0.34 kg
Travel Range	MTS25 1" (25mm) or MTS50 2" (50mm)
Software Compatibility	APT Server CDM621 V2.9.0

5.2 Motor Specification

Parameter	Value
Motor Type	DC Servo
Motor Drive Voltage	12V
Feedback	Hall Effect Encoder
Encoder Counts per Revolution of the Leadscrew	34,304
Terminal Resistance	95Ω
Output Power	0.36W
Efficiency	68%
No Load Speed	16,500rpm
No Load Current	0.004A
Stall Torque	0.82mNm
Friction Torque	0.03mNm
Speed Constant	1419 rpm/V
Back EMF Constant	0.705 mV/rpm
Torque Constant	6.73 mNm/A
Current Constant	0.149 A/mNm
Rotor Inductance	310µH

How to Calculate the Linear Displacement per Encoder Count

For the Z8 series motors, there are 512 encoder counts per revolution of the motor.

The output shaft of the motor goes into a 67:1 planetary gear head. This requires the motor to rotate 67 times to rotate the 1.0 mm pitch lead screw one revolution.

The end result is the lead screw advances by 1.0 mm.

To calculate the linear displacement of the actuator per encoder count:

512 x 67 = 34,304 encoder counts per revolution of the lead screw

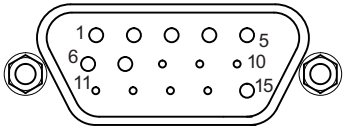
Linear displacement of the lead screw per encoder count is:

1.0 mm / 34,304 counts = 2.9 x 10^{-5} mm (29 nm)

Appendix A Motor Pin Out Details & Associated Parts

A.1 Motor Connector Pin Out

The Motor cable is terminated in a 15 way D-type connector, which provides connection to the DC motor controller. The pin functions are detailed in Fig. 1.1.



Pin	Description	Pin	Description
1	Ground/Return	9	
2	Reverse Limit Switch	10	Vcc
3	Forward Limit Switch	11	Encoder B
4		12	
5	Motor +	13	Encoder A
6		14	
7	Motor -	15	Braid/Screen
8			

Fig. 1.1 Motor Connector Pin Descriptions

A.2 Associated Products

Product Name	Part Number
Base Plate for MTS25-Z8 Stages	MTS25A-Z8
Base Plate for MTS50-Z8 Stages	MTS50A-Z8
XY Adapter Plate for MTS25-Z8 Stages	MTS25B-Z8
XY Adapter Plate for MTS50-Z8 Stages	MTS50B-Z8
Right Angle Bracket for MTS25-Z8 Stages	MTS25C-Z8
Right Angle Bracket for MTS50-Z8 Stages	MTS50C-Z8
MTS25-Z8 60mm cage system adapters	MTS25CSA
MTS50-Z8 60mm cage system adapters	MTS50CSA

Note. All the above parts fit both imperial and metric products.

Appendix B Regulatory

B.1 Declarations Of Conformity

B.1.1 For Customers in Europe

This equipment has been tested and found to comply with the EC Directives 89/336/EEC 'EMC Directive' and 73/23/EEC 'Low Voltage Directive' as amended by 93/68/EEC.

Compliance was demonstrated by conformance to the following specifications which have been listed in the Official Journal of the European Communities:

Safety	EN61010: 2001 Installation Category II, Polution Degree II.
EMC	EN61326: 1997

B.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, persuant 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.

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

B.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. 2.1 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.

B.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.

B.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.

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