

THORLABS

PRMTZ8

Motorized Precision

Rotation Stage

User Guide



Original Instructions

HA0380T

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Chapter 1 Overview

1.1 Introduction

The PRMTZ8 precision motorized rotation stage is a variant of our popular PRM1Z8 stage, designed specifically for table top mounting.

Rotation is driven via a DC servo motor equipped with high ratio gearbox (67:1) and rotary encoder for accurate closed loop position control. The KDC101 DC servo controller is the ideal companion for achieving smooth continuous motion which can be measured through the APT and Kinesis software interfaces. The Vernier dial and 1° engraved graduation marks on the rotating plate can also be used as a guide during positioning. The precision DC motor actuator provides a minimum incremental motion of 25 arcsecond over the 360° rotation. This rotation stage is also equipped with a precision home limit switch to facilitate automated rotation to the zero datum position, allowing absolute angular positioning thereafter. The limit switch is designed to allow continuous rotation of the stage over multiple 360° cycles.

The attachment holes in the body provide stable three-point mounting to the worksurface without the need for adapter plates - see Section 3.3



Fig. 1.1 PRMTZ8 stage

Chapter 2 Safety

2.1 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.

Warning: Risk of Electrical Shock



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.

2.2 General Warnings

Warning



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 3 Installation

3.1 Unpacking

Note

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



Caution

Once removed from its packaging, the 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.

3.2 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.

The unit must not be used in an explosive environment.

3.3 Mounting

The stage is fixed directly to the worksurface in a horizontal (flat) orientation using the three holes in the main body - see Fig. 3.1. The top surface of the rotating platform is 25.0 mm from the work surface.

The rotating platform features an array of threaded holes for mounting accessories such as our PM3 and PM4 Clamping Arms.



Caution



When mounting components, or fitting the stage within an application, do not apply excessive pressure to the moving platform.

Before use, ensure that any devices mounted on the moving platform are fixed securely.

Fig. 3.1 PRMTZ8 fixed to the work surface (shown with KDC101 controller)

3.3.1 Connecting The Motor Driver



Caution

It is recommended that the PRMTZ8 stages be driven by the Thorlabs KDC101 DC Servo Motor Driver, however they can also be driven by legacy TDC001 T-Cube DC Driver units. In this case, the APT or Kinesis GUI will display PRM1Z8 as the stage type, rather than PRMTZ8 (as shown on next page). All other operating parameters remain the same.

If the stage is being driven by any other driver or controller, consult Section 6.1. 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 Male D-Type connector. This is compatible with the MOTOR drive terminal of the KDC101 K-Cube DC driver unit - see Fig. 3.2 below. A 3m (9.8 ft) extension cable (PAA632) is available on request.

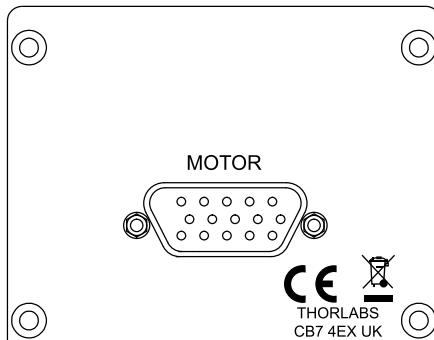


Fig. 3.2 KDC101 rear panel

3.4 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.

Chapter 4 Operation

4.1 Introduction

Caution



The PRMTZ8 stages form part of the Thorlabs Nanopositioning system. We recommend they are driven by the Thorlabs KDC101 K-Cube DC Servo Motor Driver, however they can also be driven by legacy TDC001 T-Cube DC Driver units. In this case, the APT or Kinesis GUI will display PRM1Z8 as the stage type, rather than PRMTZ8 (as shown on next page). All other operating parameters remain the same.

If the stage is being driven by any other driver or controller, consult the Section 6.1. for motor pin out details.

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.

The stages can be driven without connection to a PC, whereby control is achieved by using the controls on the top panel of the K-Cube controller. For more information please see the handbook for the KDC101 Brushed DC Controller available from www.thorlabs.com.

Remote operation via a PC is achieved via the APT and Kinesis software packages which can be downloaded from the Services section of our website. Control using both these utilities is described in the Section 4.2. and Section 4.3.

4.2 Operation with APT Software

- 1) Connect the stage to the DC motor driver and power up the unit - see Fig. 3.2.
- 2) Connect the driver to the control PC.
- 3) 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 GUI panel shown below is displayed..

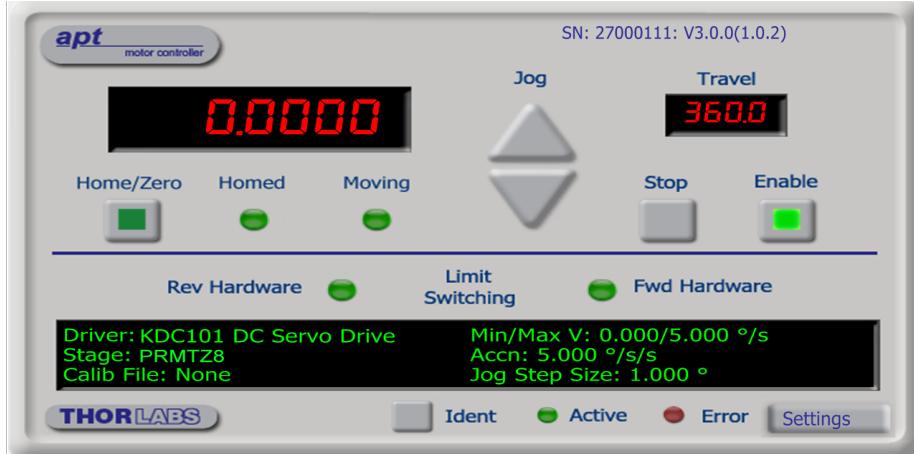


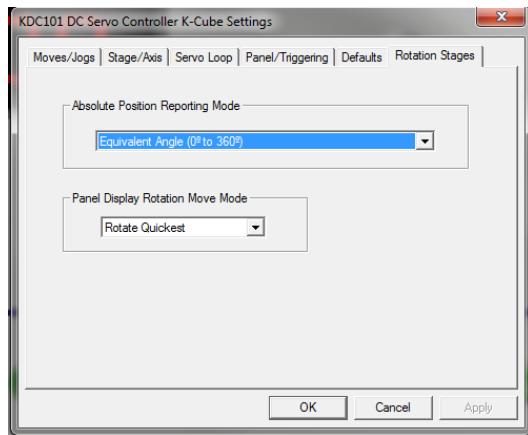
Fig. 4.1 APTUser GUI screen

When the APTUser utility was run up, default settings applicable to the PRMTZ8 stage were loaded. These settings can now be tailored to your particular application.

- 4) Check that the PRMTZ8 stage type is displayed as shown above.
- 5) Click the Settings button on the GUI to display the Settings panel.
- 6) Click each tab in turn, and make parameter changes as necessary. If in doubt, run your application with the default settings unchanged until performance data is available.
- 7) After the parameter changes have been performed, click the 'Persist Settings to Hardware' box on each tab, then click 'OK'. This will ensure that the same parameter settings will be loaded next time the unit is powered up - even in the absence of a PC.
- 8) On the GUI panel, click the 'HOME' button to move the stage to its home position. This will establish a zero datum from which future moves can be measured.

4.2.1 Rotation Stage Settings

The manual supplied for the controller unit contains full details of the various settings tabs, however the PRMTZ8 stage displays an extra tab for Rotation settings.



Absolute Position Reporting Mode

This setting relates to the way in which the angular position is displayed on the GUI panel. There are two options:

Equivalent Angle 0 to 360 degrees – The maximum displayed position is 359.99°. If a stage is driven past the 360° rotation point, the display reverts back to zero and counts up to 360° again.

Total Angle (360 x Num Revs + Angular Offset) – The total angular rotation is displayed, e.g. for a movement of two full rotations plus 10°, the display will show 730°.

Note. The following parameters are applicable only if the Absolute Position Reporting Mode is set to 'Equivalent Angle 0 to 360 degrees'.

Panel Display Rotation Move Mode

This setting specifies the move direction. There are three options:

Rotate Positive – The move is performed in a positive direction

Rotate Negative - The move is performed in a negative direction

Rotate Quickest - The move is performed in the quickest direction

4.3 Operation with Kinesis Software



Caution

Thorlabs often releases updated firmware for bug fixes and support for new features. We recommend all users to download the latest version of Kinesis software and use the included firmware update utility. Failure to do this could result in stages not being recognized by the latest controllers.

- 1) Connect the stage to the DC motor driver (see Fig. 3.2) and power up the unit.
- 2) Connect the driver to the control PC.
- 3) Run the software - Start/Programs/Thorlabs/Kinesis/Kinesis
The server reads in the stage and controller information on boot up and the GUI panel shown below is displayed..

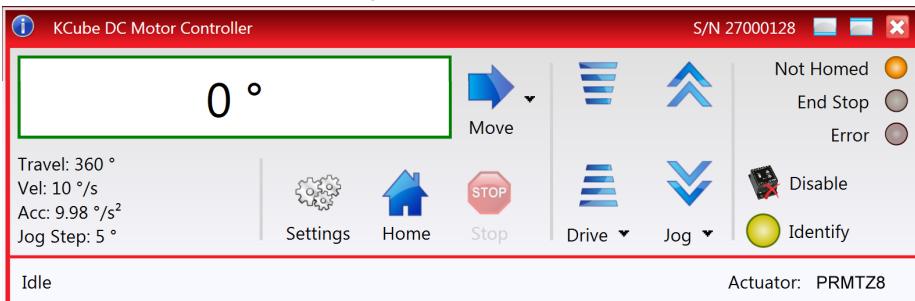


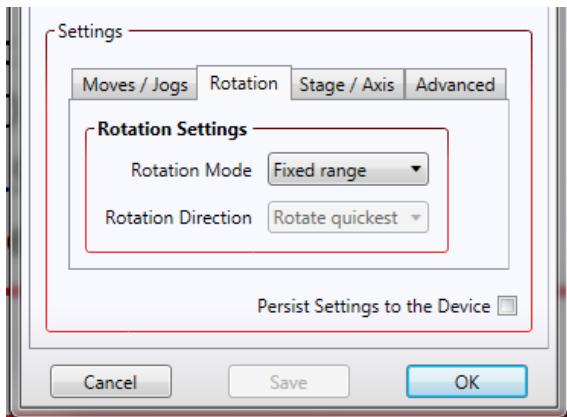
Fig. 4.2 GUI screen

When the software was run up, default settings applicable to the PRMTZ8 stage were loaded. These settings can now be tailored to your particular application.

- 4) Check that the PRMTZ8 stage type is displayed in the bottom right of the GUI panel.
- 5) Click the Settings button on the GUI to display the Settings panel.
- 6) Click each tab in turn, and make parameter changes as necessary. If in doubt, run your application with the default settings unchanged until performance data is available - see Section 4.3.1. and also the handbook supplied for the KDC101 controller.
- 7) After the parameter changes have been performed, click the 'Persist Settings to Hardware' box on each tab, then click 'OK'. This will ensure that the same parameter settings will be loaded next time the unit is powered up - even in the absence of a PC.
- 8) On the GUI panel, click the 'HOME' button to move the stage to its home position. This will establish a zero datum from which future moves can be measured.

4.3.1 Rotation Stage Settings

The manual supplied for the controller unit contains full details of the various settings tabs, however the PRMTZ8 stage displays an extra tab for Rotation settings.



Rotation Mode - This setting relates to the way in which the angular position is displayed on the GUI panel.

Equivalent Angle - The maximum displayed position is 359.99°. If a stage is driven past the 360° rotation point, the display reverts back to zero and counts up to 360° again.

Total Angle - The total angular rotation is displayed, e.g. for a movement of two full rotations plus 10°, the display will show 730°.

Fixed Range - The angular rotation is limited to 360° i.e. one revolution.

Rotation Direction - This setting specifies the move direction.

Note. These parameters are applicable only if the Rotation Mode above is set to 'Equivalent Angle'.

Rotate Forwards - The move is performed in a positive direction

Rotate Reverse - The move is performed in a negative direction

Rotate Quickest - The move is performed in the quickest direction

4.4 Maintenance

Caution

The stage contains no user-servicable parts and must be returned to the manufacturer for service.

Chapter 5 Specifications

Parameter	Value
Stage Specifications	
Range	360° Continuous
Bidirectional Repeatability	±0.1°
Backlash	±0.3° ^a
Max Rotation Velocity	25 deg/sec
Calculated Resolution	2 arcsec (0.0005°)
On-Axis Load Capacity, Horizontal Mounting ^b	15 N (1.5 kg/3.4 lbs)
Min Repeatable Incremental Motion	0.04°
Percentage Accuracy	0.1%
Home Location Accuracy	±0.2°
Wobble	200 µrad
Motor Specifications	
Motor Type	DC Servo
Nominal voltage	6 V
No load speed	6560 rpm
No load current	7.43 mA
Nominal speed	1050 rpm
Nominal torque (max. continuous torque)	1.26 mNm
Nominal current (max. continuous current)	0.156 A
Stall torque	1.54 mNm
Starting current	0.184 A
Max. efficiency	65%
Terminal resistance	32.7 Ω
Terminal inductance	0.607 mH
Torque constant	8.38 mNm/A
Speed constant	1140 rpm/V
Speed / torque gradient	4450 rpm/mNm
Mechanical time constant	13.9 ms
Rotor inertia	0.298gcm ²

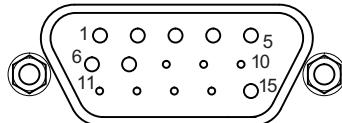
^a With backlash correction enabled, see the handbook for the KDC101 controller for more details.

^b The stage is not intended for vertical mounting, e.g. on a post.

Chapter 6 Pin Out Details & Associated Products

6.1 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. 6.1.



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

Fig. 6.1 Motor Connector Pin Descriptions

Chapter 7 Regulatory

7.1 Declarations Of Conformity

7.1.1 For Customers in Europe

See Section 7.2.

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 CE Certificates

	THORLABS www.thorlabs.com	
EU Declaration of Conformity <small>in accordance with EN ISO 17050-1:2010</small>		
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)	
2014/30/EU	Electromagnetic Compatibility (EMC) Directive	
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)	
hereby declare that:		
Model: PRMT Series		
Equipment: Motorised Precision Rotation Stage		
is in conformity with the applicable requirements of the following documents:		
EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk 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:	On: 23 May 2017	
		
Name:	Keith Dhese	
Position:	General Manager	
 EDC - PRMT Series -2017-05-23		
		

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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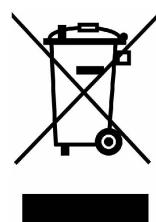
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Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not disassembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.



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