



NR360S

Motorized 360° Rotation Stage

User Guide



Original Instructions



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Chapter 1 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 Description

The NanoRotator NR series rotation stage provides arc-second resolution when driven from a microstepping stepper motor controller. The low profile design, measuring just 55mm high, is made possible by the use of two compact precision bearings. The rotating carriage of the stage provides continuous rotation of load of up to 50kg and has a 50mm clear aperture to allow the passage of the optical path directly through the stage. The main body of the stage is made from lightweight aluminum and can attach directly to an optical table, or be mounted at any orientation via the 9 mounting holes provided along four surfaces of the device. A worm gear assembly is used to transfer the rotary motion of the stepper motor into rotary motion of the carriage. There is a mechanical reduction in this gear assembly that provides one revolution of the carriage for every 66 turns of the stepper motor.

An electrical limit switch has been fitted to allow the user to datum the Nanorotator but this limit switch is only active in the negative direction. This means that the Nanorotator will run to infinity in the positive direction, but will not pass zero in the negative direction. If a movement is programmed that takes the manipulator past its negative limit, the limit switch will trip and stop the motor. It is then only be possible to execute moves in the positive direction until the limit switch is no longer tripped.

The Nanorotator is designed specifically to operate with the BSCxxx benchtop stepper motor controllers or the MST60x modular stepper motor control unit.

For further information on these controllers, please refer to the relevant manuals.

2.2 Accessories

Several mounting plates are available which allow the stage to be fixed to an optical table in either horizontal or vertical configurations. The adapter plates allow device holders to be fitted to the rotating platform. The stage can also be mounted onto one of our NST or TravelMax long travel stages.

NR360SP1 - Table Mounting Plate: This adapter plate is used to mount the NR360S rotation stage to a large flat surface such as an optical table. The 10mm thickness provides clearance for the stepper motor body which extends below the bottom surface of the stage, and ensures that the stage sits flat on the mounting surface.

NR360SP2 - Vertical Mounting Bracket: Allows the NR360S rotation stage to be mounted in a vertical orientation.

NR360SP4 - Grooved Carriage Plate: This adapter plate provides an easy means to integrate all of the miscellaneous accessories from our fiber launch systems product line. These accessories include optical mounts, tip-tilt mounts, as well as fiber holders. Please see the Accessories tab on the main NR360S stage page for more details on the range of accessories available.

NR360SP5 - Mounting Plate: This mounting plate allows the NR360S stage to be attached to a LNR50 TravelMax, or NRT stage.

NR360SP8 - SM1 Adapter Plate: This mounting plate features an SM1 threaded through hole and allows 1" optics and our SM1 product line to be mounted to the NR360S.

NR360SP9 - 1/4"-20 and 8-32 Threaded Adapter Plate: Provides numerous options for attaching devices to the NR360S: includes 17 1/4"-20 Mounting holes, and four 8-32 fixing holes.

NR360SP9/M - M6 and M4 Threaded Adapter Plate: Provides numerous options for attaching devices to the NR360S: includes 17 M6 Mounting holes, and four M4 fixing holes.

Chapter 3 Operation

3.1 Using the Nanorotator with the APT System

3.1.1 Background

The hybrid stepper motor used in the actuator, with its rotor that consists of 50 individual magnetic teeth, is ideally suited for micro-stepping applications. Aside from the obvious increase in resolution provided by increasing the steps per revolution from 200 to 409,600, micro-stepping also ensures smoother low speed motion by allowing the discrete 1.8° step size, which produces vibrational noise, to be reduced to much smaller steps with inherently lower resultant vibrational noise.

The rotation stage utilizes a worm gear assembly which provides one complete rotation of the platform for every 66 turns of the stepper motor. When used with the APT™ Series stepper motor controller, the stepper motor provides 409,600 steps per revolution resulting in $66 \times 409,600$ steps per revolution of the stage. This results in a $360/(66 \times 409,600)^\circ$ or 13.3×10^{-6} degrees of platform rotation per microstep.

The Nanorotator is connected to the Stepper Motor Controller via a flying lead terminated in a D-type type connector.



Caution



The relevant stepper motor controller or channel must be switched off/disabled before the Nanorotator is plugged in or unplugged. Failure to switch the controller off may result in damage to either the controller, the Nanorotator, or both.

Manual control of the Nanorotator can be achieved by switching off the drive to the motors. Please refer to the relevant controller manual.



Caution



The electrical limit switch does not operate when the motor is being turned by hand. Care must be taken to avoid fouling if the drive is turned past the limit switch.

3.1.2 System Setup

- 1) Install the electronic hardware and connect the modules to the relevant axes of the associated stages (see the handbooks supplied with the APT Controllers).
- 2) For each Stepper Motor Controller in your system, fit the interlock plug (supplied) to the MOTOR CONTROL connector on the rear panel.
- 3) Shut down all applications using the APT server (e.g. APT User or your own custom application).
- 4) Run the APT Config utility - Start/All Programs/Thorlabs/APT Config/APT Config.

- 5) From the 'APT Configuration Utility' window, click the 'Stage' tab.

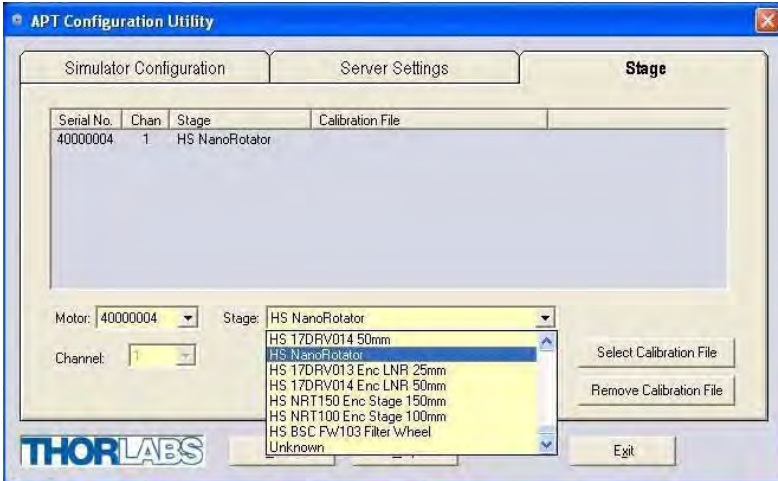


Fig. 3.1 APT Configuration Utility - Stage Tab

- 6) In the 'Motor' field, select the serial number of the stepper motor controller to be configured (this number can be found on the rear panel of the controller unit).

Note

To ensure correct operation, it is important to select the correct stage type for your controller. If using a BSC20x series controller, select the 'HS NanoRotator' option. If using a legacy BSC0xx or BSC10x controller, choose an option without the 'HS' prefix.

Selecting an incompatible stage type could result in reduced velocity and resolution.


- 7) In the 'Stage' field, select 'HS NanoRotator' from the list displayed.
 8) Click the 'Add Stage Association' button.
 9) A default configuration is set at the factory and stored in the non-volatile memory of the motor controller. The server reads in the stage and controller information on start up. See the handbook supplied with the stepper motor controller for further information.

Note


In applications where continuous rotation is necessary for prolonged periods, it is possible that the position register inside the controller could overflow. In this case, the stage will continue to operate, but the position readout is no longer accurate. Homing the stage will restore the positional accuracy.

Chapter 4 Installation

4.1 Unpacking




Cautions




Once removed from its packaging, the NanoRotator is easily damaged by mishandling. The unit should only be handled by its base, not by the top platform or any attachments to the top platform.

Do not carry the Nanorotator by the drive actuator. Serious damage may occur if excessive force is applied to the drive.

4.2 Transportation

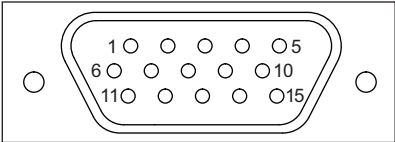


Caution



When packing the unit for shipping, use the original packing. If this is not available, use a strong box and surround the NanoRotator with at least 100 mm of shock absorbent material.

4.3 Electrical Connections



Pin	Description
1	Limit Switch Ground *
2	Not Used
3	CW Limit Switch
4	Ph B -ve
5	Ph B +ve
6	Ph A -ve
7	Ph A +ve
8 to 14	Not Used
15	Earth

Note.

* The limit switch ground is connected to the motor body.

4.4 Attaching to a Work Surface

Several mounting plates are available which allow the stage to be fixed to an optical table in either horizontal or vertical configurations. The adapter plates allow device holders to be fitted to the rotating platform. The stage can also be mounted onto one of our NRT or LNR series long travel stages.



Caution



To prevent excessive distortion, use nylon washers under the heads of the securing screws.

See Section 2.2. for a description of the mounting and adapter plates. Dimensions are detailed in Section 4.6.

Accessory	Part Number
Table Mounting Plate (Imperial)	NR360SP1
Table Mounting Plate (Metric)	NR360SP1/M
Vertical Mounting Bracket (Imperial)	NR360SP2
Vertical Mounting Bracket (Metric)	NR360SP2/M
Grooved Carriage Plate (Imperial)	NR360SP4
Grooved Carriage Plate (Metric)	NR360SP4/M
Mounting Plate to NST or LNR (Imperial)	NR360SP5
Mounting Plate (Metric)	NR360SP5/M
SM1 Adapter Plate	NR360SP8

4.5 Attaching Components and Devices



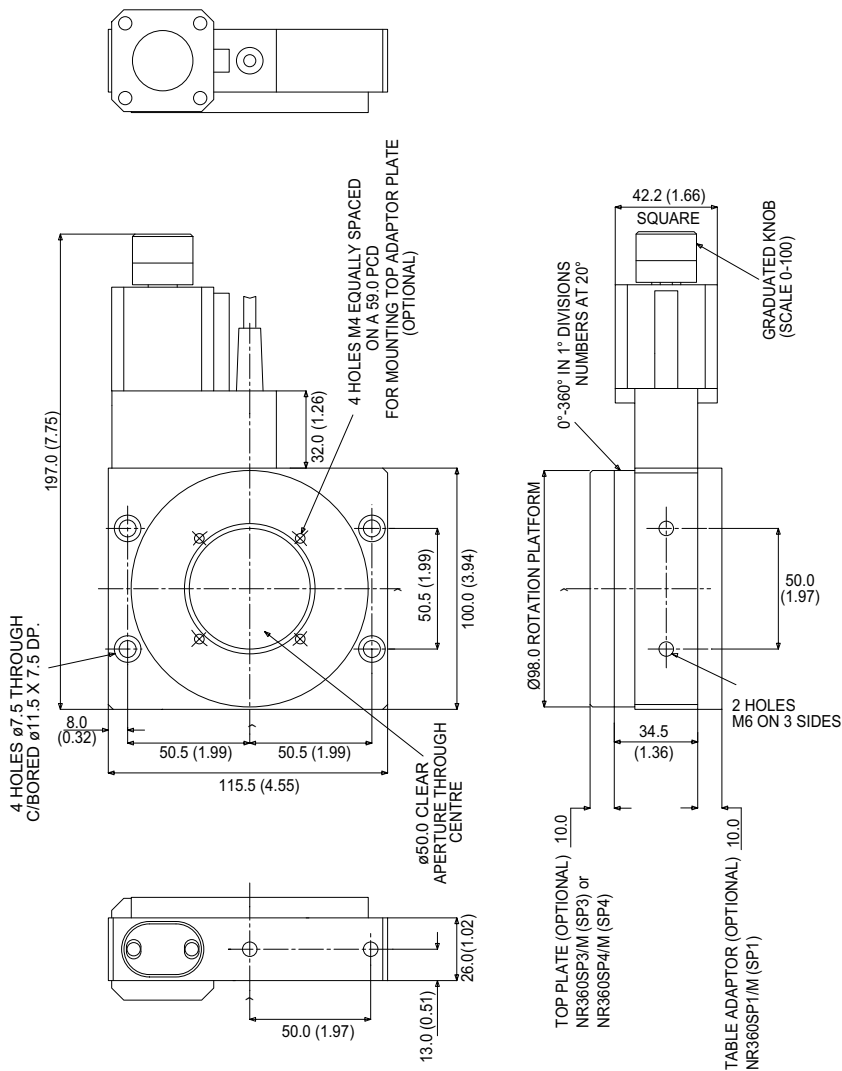
Caution



Users must ensure that components and devices fitted to the unit are properly secured to the moving platform

4.6 Dimensions

4.6.1 NanoRotator Dimensions



all dimensions in millimetres (inches)

Fig. 4.1 NanoRotator dimensions

4.6.2 Table Mounting Plate

all dimensions in millimetres (inches)

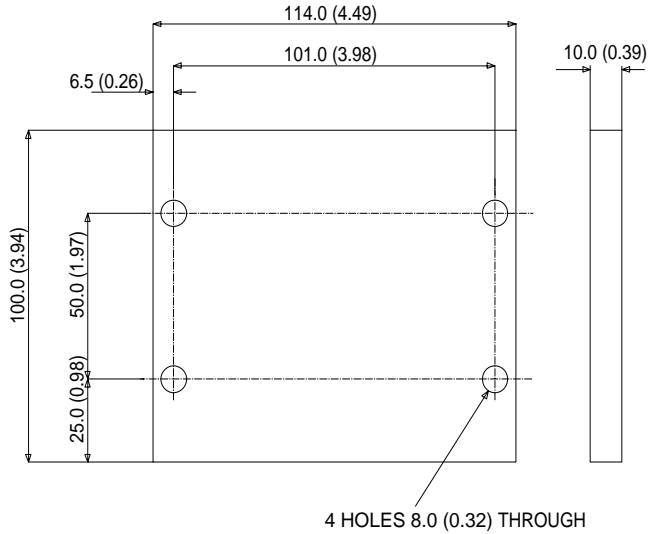


Fig. 4.2 Table mounting plate dimensions

4.6.3 LNR or NRT Stage Mounting Plate

all dimensions in millimetres (inches)

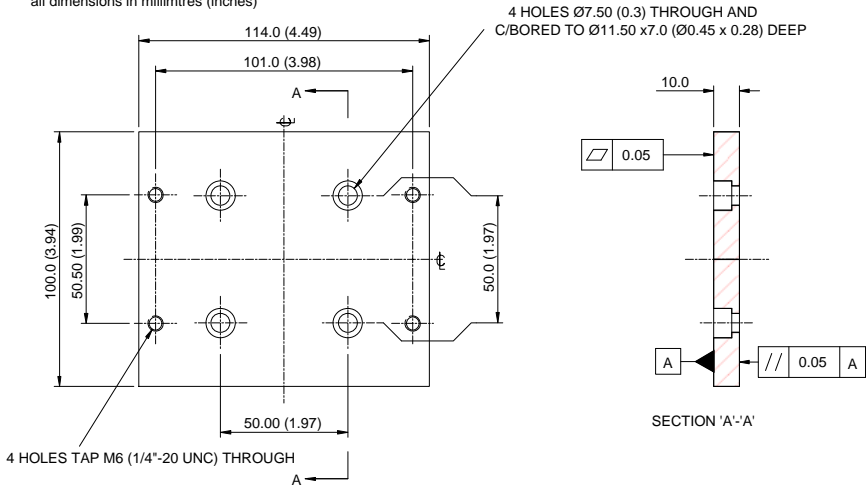


Fig. 4.3 LNR/NRT Stage mounting plate

4.6.4 Vertical Mounting bracket

all dimensions in millimetres (inches)

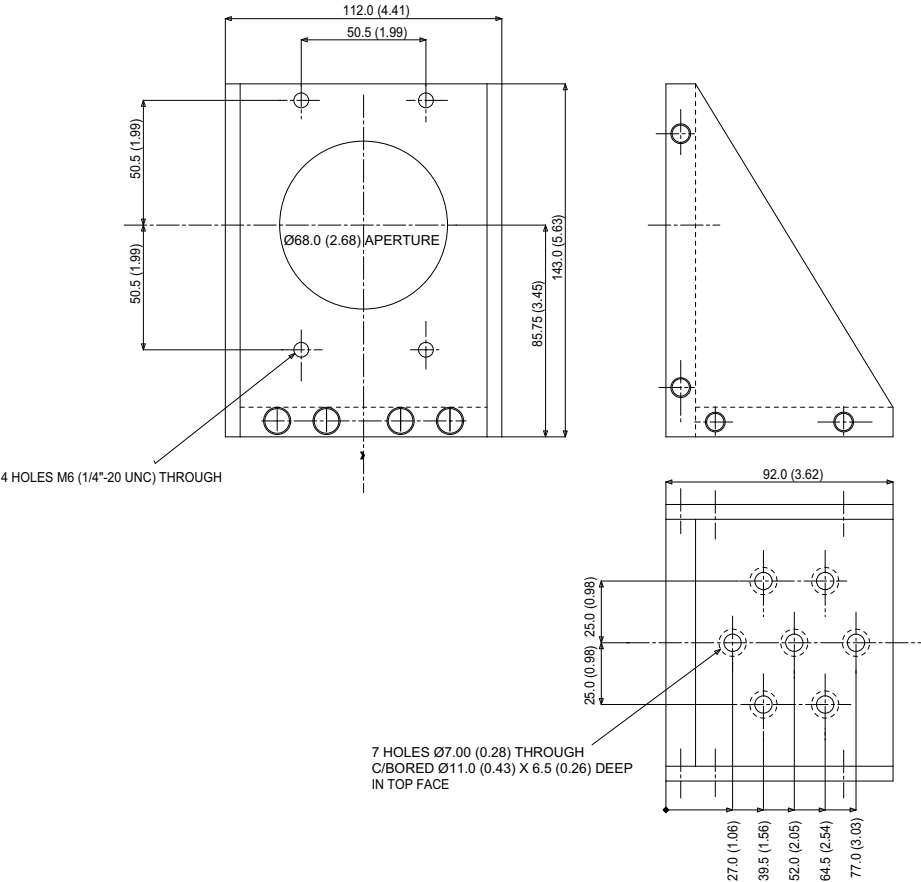


Fig. 4.4 Vertical mounting bracket

4.6.5 Grooved Carriage Plate

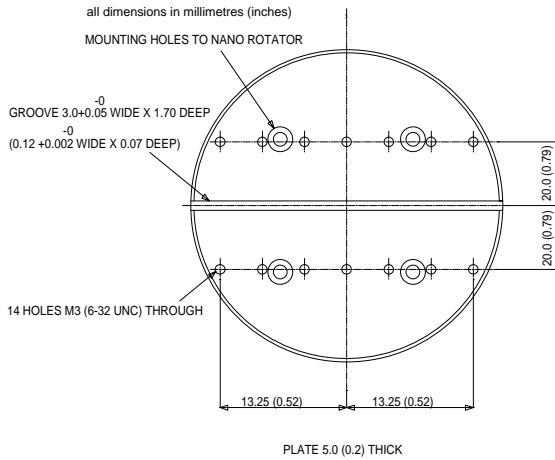


Fig. 4.5 Grooved carriage plate

Other mounting and adpater plates are available, please see Chapter 6 and www.thorlabs.com for more details.

Chapter 5 Specification

Parameter	Value
General Specifications	
Construction	Aluminum Body and Platform with Black Finish
Travel	360° Continuous Rotation
On Axis Load Capacity*	110 lbs (50 kg)
Drive Mechanism	Worm Drive
Gear Ratio	66:1
Limit Switches	Mechanical, Normally Open Reference Signal Every 360°
Motor Type	2 Phase Stepper
Accuracy	5 arcmin (If used with BSC201)
Bidirectional Repeatability	10 arcsec
Speed Range*	50°/ sec (If used with BSC201)
Acceleration*	80°/ sec/sec (If used with BSC201)
Recomended Controller	BSC201
Weight (Actuator)	3.11 lbs (1.4 kg)
Motor Specifications	
Step Angle	1.8° (50 poles & ±2 phases for 360°/200 steps)
Step Accuracy	5%
Rated Phase Current	1A
Resistance / Phase	3.6 Ω
Inductance / Phase	4.6mH
Holding Torque	23.1N.cm
Detent Torque	1.7N.cm

* The speed and acceleration quoted above are only achievable with light loads. When using heavy loads, the speed should be reduced accordingly.

Chapter 6 Parts List

Description	Part Number
Table Mounting Plate (Imperial)	NR360SP1
Table Mounting Plate (Metric)	NR360SP1/M
Vertical Mounting Bracket (Imperial)	NR360SP2
Vertical Mounting Bracket (Metric)	NR360SP2/M
Grooved Purpose Carriage Plate (Imperial)	NR360SP4
Grooved Purpose Carriage Plate (Metric)	NR360SP4/M
Mounting Plate to NST or LNR (Imperial)	NR360SP5
Mounting Plate to NST or LNR (Metric)	NR360SP5/M
SM1 Threaded Adapter Plate	NR360SP8
1/4"-20 and 8-32 Threaded Adapter Plate	NR360SP9
M6 and M4 Threaded Adapter Plate	NR360SP9/M
Handbook	HA 0040T

Chapter 7 Regulatory

7.1 Declarations Of Conformity

7.1.1 For Customers in Europe

See Section 7.3.

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 Waste Electrical and Electronic Equipment (WEEE) Directive

7.2.1 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. 7.1 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.

7.2.2 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.

7.2.3 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.

7.3 CE Certificate



THORLABS
www.thorlabs.com

EU Declaration of Conformity
in accordance with EN ISO 17050-1:2010

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)
2004/108/EC	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: **NR360 Series**

Equipment: **NanoRotator with SM2 Threaded 50mm Centre Hole (Imperial and Metric)**

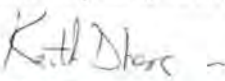
is in conformity with the applicable requirements of the following documents:

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: 10 September 2014

Name: Keith Dhese

Position: General Manager

EDC - NR360 Series -2014-09-10



Chapter 8 Thorlabs Worldwide Contacts

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