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DRV208
Stepper Motor Actuator

User Guide



Original Instructions

Contents

Chaper 1 Overview 1
1.1 Introduction 1
Chaper 2 Safety 2
2.1 Safety Information 2
2.2 General Warnings and Cautions 2
Chaper 3 Operation and Maintenance 4
3.1 Selecting the Stage Type 4
3.2 Maintenance 7
3.3 Using the MCA Modular Quick Connect Adapters 8
3.4 Motor Connector Pin Out 9
Chaper 4 Specification 10
Chaper 5 Regulatory 11
5.1 Declarations Of Conformity 11
5.1.1 For Customers in Europe 11
5.1.2 For Customers In The USA 11
5.2 CE Certificate 12
Chaper 6 Thorlabs Worldwide Contacts 13

Chapter 1 Overview

1.1 Introduction

This Stepper Motor Actuator is designed for use with Thorlabs stages compatible with modular drives (such as our 3- and 6-axis NanoMax stages). However, it can be fitted to other stages by using a Modular Quick Connect Adapter (MCA1 for Ø3/8" mounting or MCA2 for Ø10mm mounting).

When driven by a Thorlabs BSC20x series stepper motor controller, this actuator is capable of speeds as high as 5 mm/sec and offers a nominal travel of 8 mm. The powerful stepper motor is capable of handling a maximum force of 180 N and delivers a bidirectional repeatability of 5.0 µm.

The knurled knob on the rear shaft of the motor is an inertial damper. When the actuator is powered down, It can also be used to position the actuator manually.

Note

Manually adjusting the actuator will cause the position to no longer be synchronised to the position display in the control software - this can lead to overrunning travel limits unexpectedly. If the actuator is powered down and moved by hand, ensure that it is homed immediately after power up.

The full travel range of the DRV208 Stepper Motor Actuator is 8 mm (0.31")but this range is limited to 4 mm while using with the nanomax stages.

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 and Cautions



Warning

If this equipment is used in a manner not specified in the handbook, 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.

The equipment is for indoor use only.



Warning

To avoid injury never put any part of your body in the gap between the actuator and a rigid structure.

Warning

The actuator may heat up when operated, and this is indicated by the warning hot surface symbol  on the product engraving.

Increased speeds, high duty cycles, and ambient temperature will all affect the temperature of the actuator. Special care should be taken when handling the product under these conditions, in particular when touching the damping knob and motor body.

Caution

If the actuator encounters a hard stop while still in the middle of its range (i.e. a translation stage at the end of its travel range or an obstruction in the path of the moving platform), the motor should be stopped as soon as possible to prevent damage to the drive mechanism and to keep the unit from overheating.

When the DRV208 motors are used with our Nanomax series stages, suitable defaults are loaded at start up to prevent the motor being overdriven. When fitted to other stages or third party optomech products, it is possible that the motor will reach the mechanical hardstops of the stage before the travel limits of the actuator. In this case, consideration should be given to creating custom travel limit settings - see the handbook for the associated motor controller for more information.

DO NOT continue to drive the motor into the hardstop as this will damage the motor.

Caution

The control PC used to operate the driver for the DRV208 actuators must be running APT Software v3.21.3 or Kinesis Software version 1.14.12 or higher.

Earlier versions of software do not support this product.

Caution

When storing these units, be sure to fully retract the lead screw to protect the threads from damage. Improper connection of the motor will result in permanent damage. All power supplied to the motor should be turned off before altering any connections to the motor. Check all connections before supplying power to the motor.

Chapter 3 Operation and Maintenance

3.1 Selecting the Stage Type

To ensure that a particular stage is driven properly by the system, a number of parameters must first be set. These parameters relate to the physical characteristics of the stage being driven (e.g. min and max positions, leadscrew pitch, homing direction etc.).

To assist in setting these parameters correctly, it is possible to associate a specific stage type and axis with the motor controller channel. Once this association has been made, the server automatically applies suitable default parameter values on boot up of the software.

Note

To ensure correct operation, it is important to select the correct stage and axis type as described above. Selecting an incompatible stage/axis type could result in reduced velocity and/or resolution, and in the worst case could cause the motor to run into the end stops or home incorrectly.

Using Kinesis Software

Caution

The host PC must be running Kinesis v1.14.12 or higher.

1) Install the electronic hardware and connect the modules to the relevant axes of the associated stages (see the handbooks for the associated controller).
2) For each Stepper Motor Controller in your system, fit the interlock plug (supplied) to the MOTOR CONTROL connector on the rear panel.
3) Ensure that the device is connected to the PC and powered up.
4) Run the Kinesis software - Start/All Programs/Thorlabs/Kinesis/Kinesis.
5) On start-up, the 'Actuator/Startup Settings' window is displayed. This window allows the correct actuator to be selected.

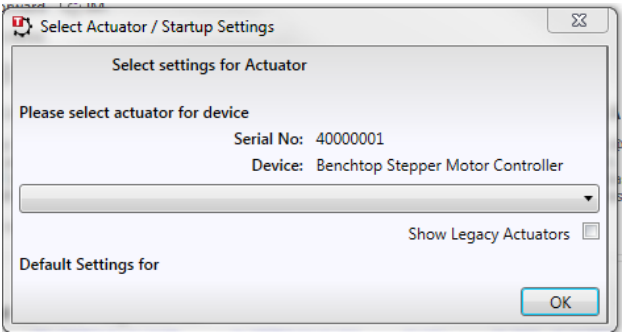


Fig. 3.1 Select Actuator Settings Window - 1

6) Select your actuator type (e.g. NanoMax 300 X-Axis (DRV208) if you have a NanoMax stage fitted with DRV208 actuators, or DRV208 if you have fitted the DRV208 actuator to a stage normally fitted with manual actuators).

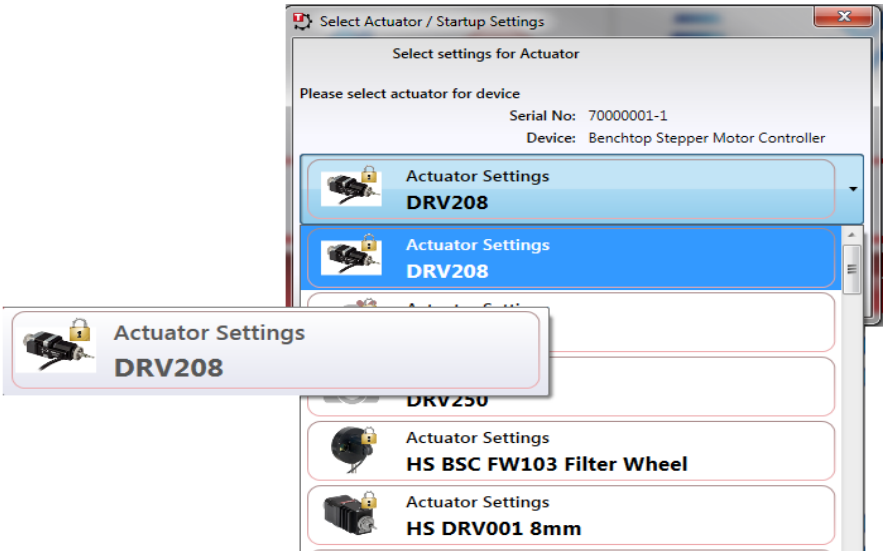


Fig. 3.2 Select Actuator Settings Window - 2

7) Click OK.
8) The server reads in the stage and controller information automatically. Refer to the handbook for the associated controller for more information on driving the actuator/stage.

Note

These stepper motor drives have no forward limit switch and the travel is limited dependent on the axis to which it is attached. When the DRV208 motors are used with our Nanomax series stages, suitable defaults are loaded at start up to prevent the motor being overdriven. If the axis is driven towards the reverse limit switch, at a certain position the platform stops moving while the drive itself continues to move until the limit switch is reached. The drive must then be moved positively by a certain distance before the platform begins to move. This distance is just less than the offset.

When fitted to other stages or third party optomech products, it is possible that the motor will reach the mechanical hardstops of the stage before the travel limits of the actuator. In this case, consideration should be given to creating custom travel limit settings - see the handbook for the associated motor controller for more information.

When creating a program to control the actuator, it is recommended to avoid running into the mechanical hard stops.

Using APT Software

Caution

The host PC must be running APT v3.21.3 or higher.

9) Install the electronic hardware and connect the modules to the relevant axes of the associated stages (see the handbooks for the associated controller).
10) For each Stepper Motor Controller in your system, fit the interlock plug (supplied) to the MOTOR CONTROL connector on the rear panel.
11) Shut down all applications using the APT server (e.g. APT User or your own custom application).
12) Run the APT Config utility - Start/All Programs/Thorlabs/APT Config/APT Config.
13) From the 'APT Configuration Utility' window, click the 'Stage' tab.

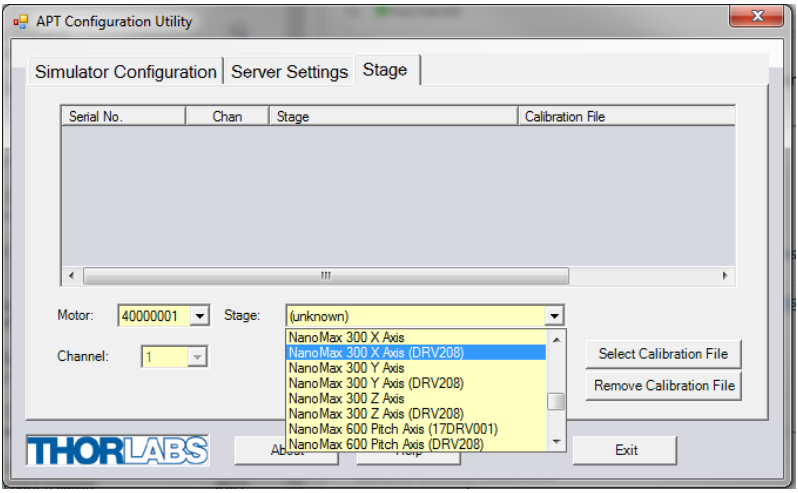


Fig. 3.3 APT Configuration Utility - Stage Tab

14) 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 and axis type as described above. Selecting an incompatible stage/axis type could result in reduced velocity and resolution.

15) In the ‘Stage’ field, select the type of stage to which the DRV208 actuator is fitted (e.g. *NanoMax 300 X Axis (DRV208)* if you have a NanoMax stage fitted with DRV208 actuators, or *DRV208* if you have fitted the DRV208 actuator to a stage normally fitted with manual actuators).
16) Click the 'Add/Change Stage Association' button.

17) 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. Refer to the handbook for the associated controller for more information on driving the actuator/stage.

Note

These stepper motor drives have no forward limit switch and the travel is limited dependent on the axis to which it is attached. When the DRV208 motors are used with our Nanomax series stages, suitable defaults are loaded at start up to prevent the motor being overdriven. If the axis is driven towards the reverse limit switch, at a certain position the platform stops moving while the drive itself continues to move until the limit switch is reached. The drive must then be moved positively by a certain distance before the platform begins to move. This distance is just less than the offset.

When fitted to other stages or third party optomech products, it is possible that the motor will reach the mechanical hardstops of the stage before the travel limits of the actuator. In this case, consideration should be given to creating custom travel limit settings - see the handbook for the associated motor controller for more information.

When creating a program to control the actuator, it is recommended to avoid running into the mechanical hard stops.

3.2 Maintenance

After prolonged use, and particularly in applications where small movements are continually repeated, the grease on the drive shaft may build up. This may cause rough or noisy movement, vibration and excessive heating.

It is good practise to run the motor periodically from one end of travel to the other several times in order to redistribute the grease.

3.3 Using the MCA Modular Quick Connect Adapters

Modular quick connect adapters allow the DRV208 actuators to be fitted to stages with standard mounting clamps (MCA1 for Ø3/8” mounting or MCA2 for Ø10mm mounting).

Simply remove the crescent ring circlip from the end of the drive rod, remove the washers, then screw on the adapters.

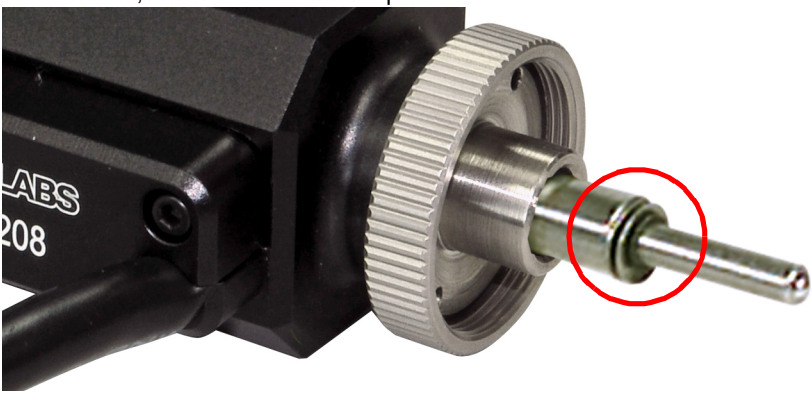


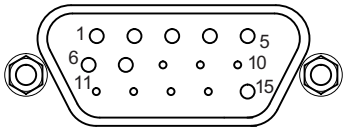
Fig. 3.4 Circlip and Washers

Caution

The circlip mentioned above must be refitted if the actuator is to be used again on a NanoMax series stage.

3.4 Motor Connector Pin Out

The 'Motor' connector provides connection to the stepper motor controller. The pin functions are detailed in Fig. 3.5.



Pin	Description	Pin	Description
1	Limit Switch 0V	9	Ident (For Future Use)
2	Limit Switch 0V	10	+5 V
3	CW Limit Switch	11	
4	Phase B -ve	12	
5	Phase B +ve	13	+5 V
6	Phase A -ve	14	
7	Phase A +ve	15	Ground
8			

Fig. 3.5 Motor Connector Pin Descriptions

3.5 Extension Cables

The motor is supplied with a 0.5m flying lead and a 3 m (PAA613) extension cable. A 1 m extension cable (PAA612) is available separately - see www.thorlabs.com for more details.

Chapter 4 Specifications

Specification	DRV208
Travel Range	8 mm
Unidirectional Repeatability	3.6 µm
Bidirectional Repeatability	5.0 µm
Absolute Accuracy	17.1 µm
Corrected Backlash	2.4 µm
Maximum Force	180 N
Maximum Velocity	5 mm/s
Maximum Acceleration	5 mm/s^2
Lead Screw Pitch	0.5 mm
Feedback	None
Limit Switches	Hall Effect
Homing Repeatability	13.5 µm
Operating Temperature Range	5° to 40° C
Humidity range	Less than 80% RH at 31° C
No of Phases	2
Full Step Angle	1.8°
Rated Voltage	4.6 V
Rated Phase Current	0.85 A
Phase Resistance	3.6 Ω
Phase Inductance	4.6 mH
Holding Torque	0.2 N•m
Rotor Inertia	24 x 10^{-7} kg•m^2
Insulation	Class B
Microsteps per Revolution of Leadscrew	409,600
Motor Type	2-Phase Stepper
Compatible Controllers	BSC201 MST602

Chapter 5 Regulatory

5.1 Declarations Of Conformity

5.1.1 For Customers in Europe

See Section 5.2.

5.1.2 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.

5.2 CE Certificate



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)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***DRV208***

Equipment: ***Stepper Motor Actuator***

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: Keith Dhese *On:* 21 September 2018

Name: Keith Dhese

Position: General Manager

EDC - DRV208 -2018-09-21

CE

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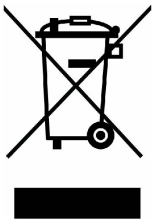
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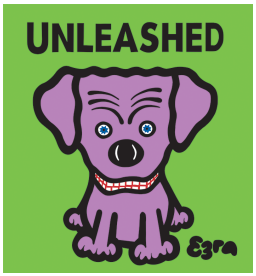
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Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical 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 dissembled 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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