DDR100
Direct Drive Rotation Stage

User Guide

Original Instructions

Contents

Chapter 1 Overview

1.1 Introduction

The Thorlabs' DDR100 low-profile, direct-drive rotary stage provides continuous rotation of a load up to 5 kg (11 lb) with 2 µrad resolution and a maximum rotation speed of up to 180 rpm. A SM1 threaded central aperture allows an optical path to pass directly through the body of the stage.

It has a 3-phase, slotless, brushless DC motor integrated directly into the frame of the stage. This eleminates all forms of mechanical transmission providing high repeatability, rigidity and reliability. The winding design eleminates torque ripple due to magnetic cogging, enabling good velocity stability even at low speeds.The high magnetic pole count produces a large amount of torque (0.7 Nm). The high resolution encoder mounted directly on the moving world provides high accuracy and repeatability, while the precision-engineered bearings and tight manufacturing tolerances produce very low axial wobble (60 µRad) and radial eccentricity (6 µm). An engraved vernier scale allows for coarse positioning.

The stage can be mounted horizontally on the work surface, or vertically on a post, AP90 or VB01 bracket. It can also be mounted directly to the DDS300 and DDS600 translation stages. The top plate features an SM1-threaded through hole to allow Ø1" optics and our SM1 product line to be mounted. The rotating and non-rotating top surfaces, and the rear face, all feature an array of 4-40 tapped holes to integrate 30 mm cage assemblies and components. The stage is also supplied with an insert, that can be fitted into the center recess, thereby allowing 30 mm and 16 mm cage system components to be mounted onto the moving world.

The stage is driven by the BBD series of brushless DC controllers, giving very precise, fine positioning and control through the stable closed-loop control system.

Its speed, presicion, and stability make this unit suitable for applications requiring high speed rotation such as scanning, surface mapping and laser welding.

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.

The equipment is for indoor use only.

When running custom move sequences, or under fault conditions, the stage may move unexpectedly. Operators should take care when working inside the moving envelope of the stage.

Keep clear of the moving world when the unit is in operation and rotating with equipment attached to the top plate.

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 can be easily damaged by mishandling. The unit should only be handled by its base, not by any attachments to the moving platform.

The unit has fragile internal components that can be damaged if the staged is dropped.

3.2 Environmental Conditions

Caution

This unit is design for operation within normal operating conditions. It is not recommended to use this equipment outside the following limits.

Location	Indoor use only
Maximum altitude	2000 m
Temperature range	5 to 40°C (41 to 104°F)
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

Warning

The safety of any system incorporating this equipment is the responsibility of the person performing the installation.

Caution

The performance of the stage could be affected if the mounting surface is not flat to within 200µm. Care should be taken when bolting the stage to the worksurface, to ensure that the base does not warp, which could cause stiffness to be experienced in the bearing rails. Shims should be fitted as necessary.

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.

3.3.1 Mounting the Stage to the Work Surface

The DDR100 stage is mounted to the work surface by four M6 x 25 mm (1/4”-20 x 1”) screws. The mounting holes are accessed from the top of the stage as shown below.

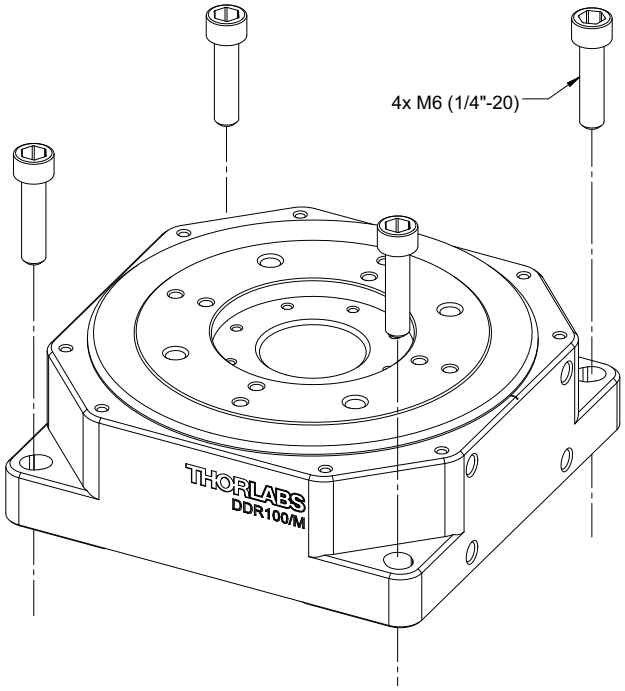


Fig. 3.1 Horizontal Mounting

The stage can be mounted directly to our DDS300 and DDS600 stages as shown below.

Fig. 3.2 DDR100 Stage mounted to a DDS600 Translation Stage

It can also be mounted to our DDS220 stage, using the adapter plate DDS220P1.

Caution

When mounted vertically, the stage will not hold position if powered down or the drive channel is disabled.

Ensure that any devices and components attached to the moving platform are securely fastened. Incorrectly attached components could come loose when the stage is operated.

3.3.2 Vertical Mounting

The stage can also be mounted vertically, using an AP90RL(/M) bracket - see Fig. 3.3.

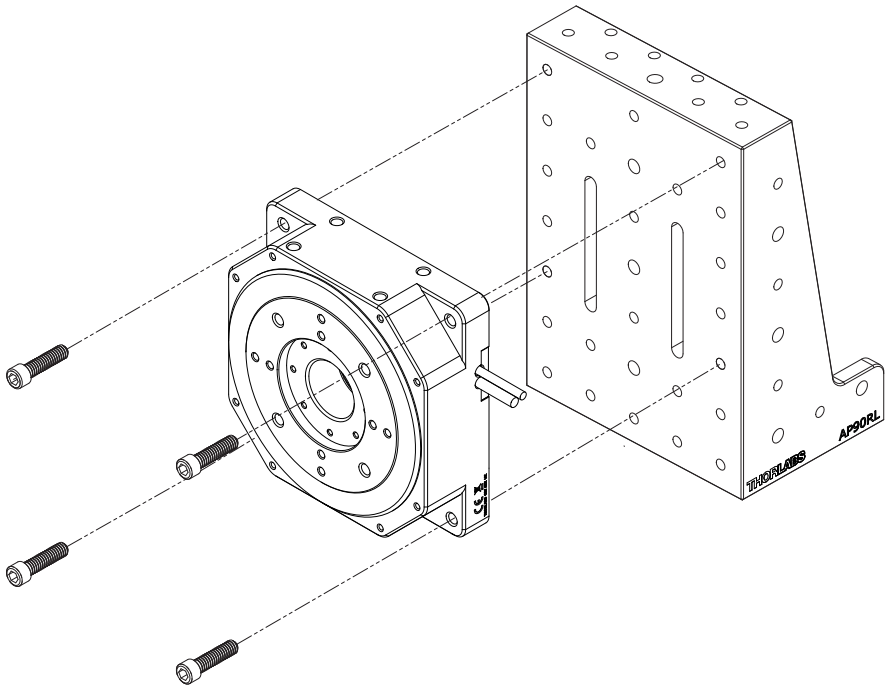


Fig. 3.3 Vertical mounting with AP90RL bracket

If the application requires the use of the central aperture, the stage can be mounted vertically using two VB01 brackets instead - see Fig. 3.4.

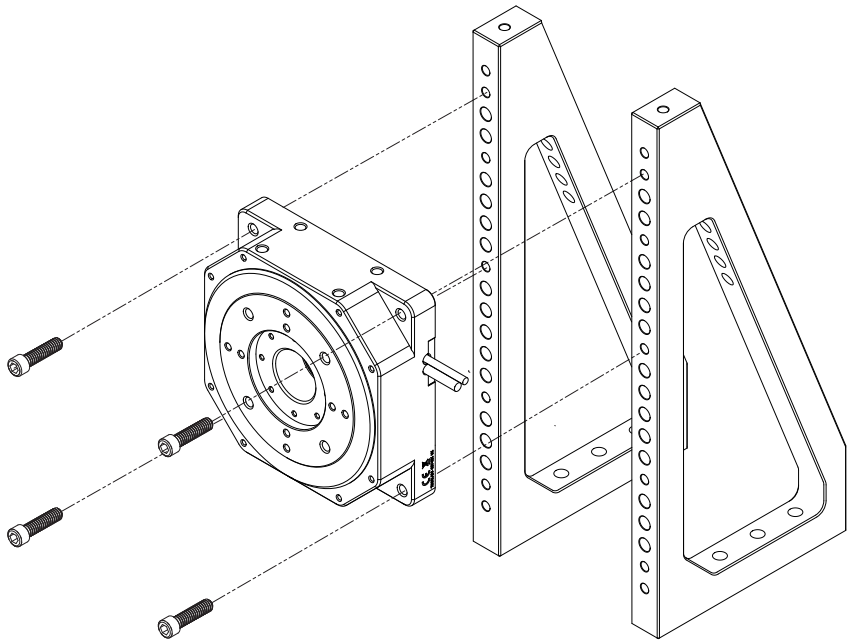


Fig. 3.4 Vertical mounting with VB01 brackets

Caution

When mounted vertically, the stage will not hold position if powered down or the drive channel is disabled.

Ensure that any devices and components attached to the moving platform are securely fastened. Incorrectly attached components could come loose when the stage is operated.

3.3.3 Post Mounting

The stage can also be mounted vertically on a post - see Fig. 3.5.

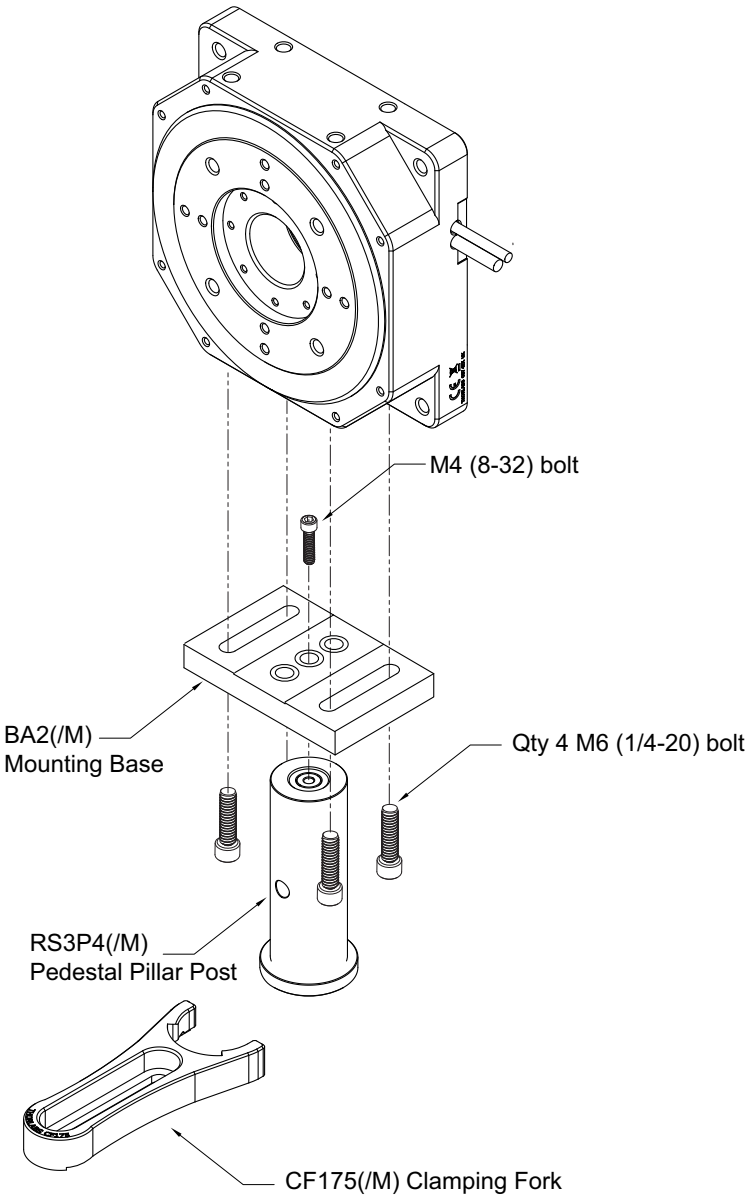


Fig. 3.5 Vertical mounting on post

Caution

Due to the increased likelyhood of vibration, post mounting is not recommended for heavy or off-centered loads.

3.3.4 Cage Mounting

An array of threaded holes in the rotating face allow 30 mm cage system components to be fitted as shown in Fig. 3.10.

The rear face is also fitted with an array of threaded holes compatible with 30 mm cage system. By using these holes, the stage can be mounted within the cage system, and components can then be rotated within the cage.

Fig. 3.6 DDR100 fitted with cage system components

The stage is also supplied with an insert, that can be fitted into the center recess, thereby allowing 30 mm and 16 mm cage system components to be mounted onto the moving world.

3.3.5 Accessories

The DDR100 stage can be used with the NR360SPx range of adapter plates. In this way, the stage is compatible with our range of tongue and groove accessories such as fiber rotators, lens holders etc.

NR360SP4 **NR360SP9**

Fig. 3.7 DDR100 stage fitted with NR360SP series adapter plates

3.4 Electrical Connections

For optimum performance, the stage must be driven by a Thorlabs BBD series controller. Connect the motor leads to the MOTOR DRIVE connectors, and the encoder feedback leads to the FEEDBACK connectors. Ensure that the motor drive and feedback leads for each motor are connected to the correct channel.

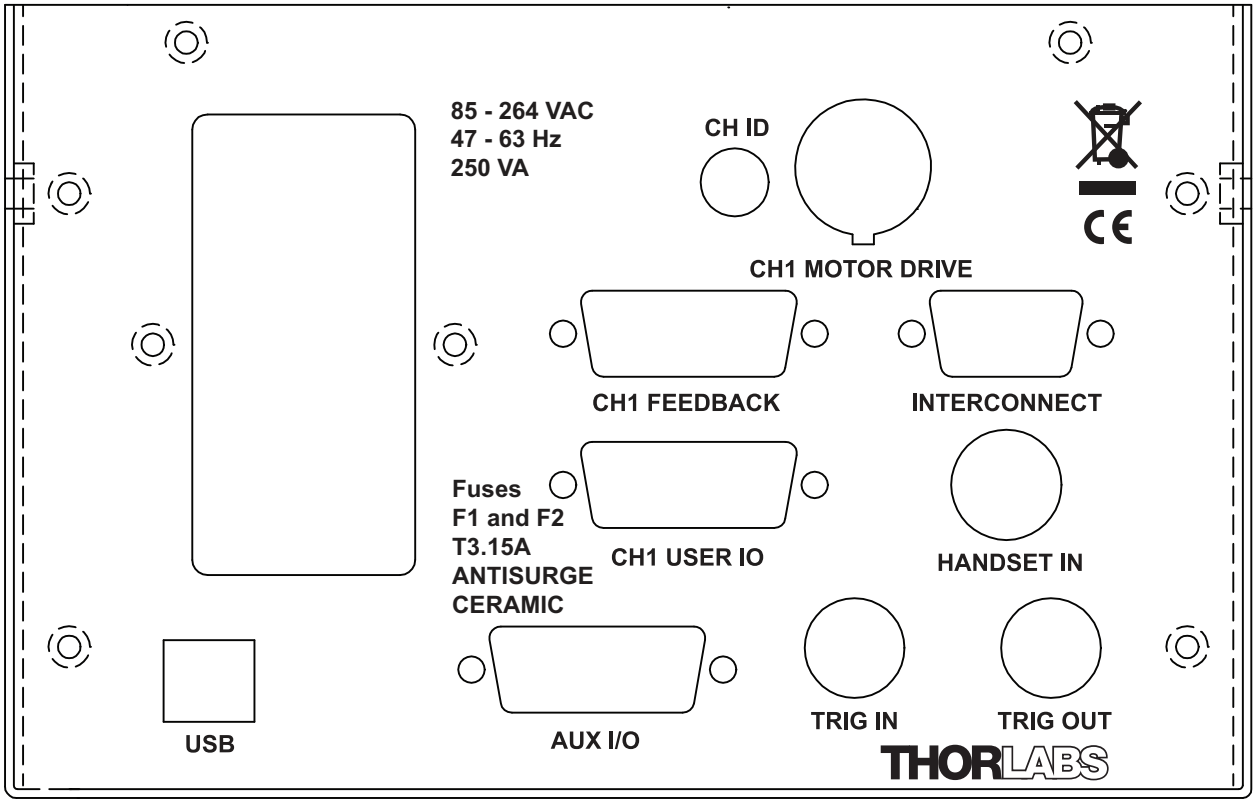
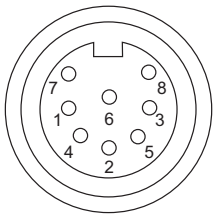


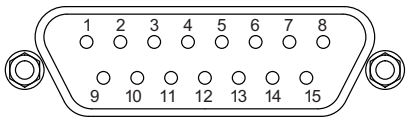
Fig. 3.8 Electrical connections

Pin out information for the motor drive and encoder feedback connectors on the motor flying leads is detailed below.



MOTOR DRIVE

1	Motor Phase V	5	Stage ID
2	GND	6	GND
3	Thermistor (not used)	7	Motor Phase W
4	Motor Phase U	8	Enable



ENCODER FEEDBACK

1		9	GND
2	GND	10	Limit Switch +
3		11	Limit Switch -
4	Enc Index -	12	Enc Index +
5	QB -	13	QB +
6	QA -	14	QA +
7	5 V	15	x
8	5 V		

Fig. 3.9 Motor Drive and Feedback Flying Lead Pin Out Details

3.5 Dimensions

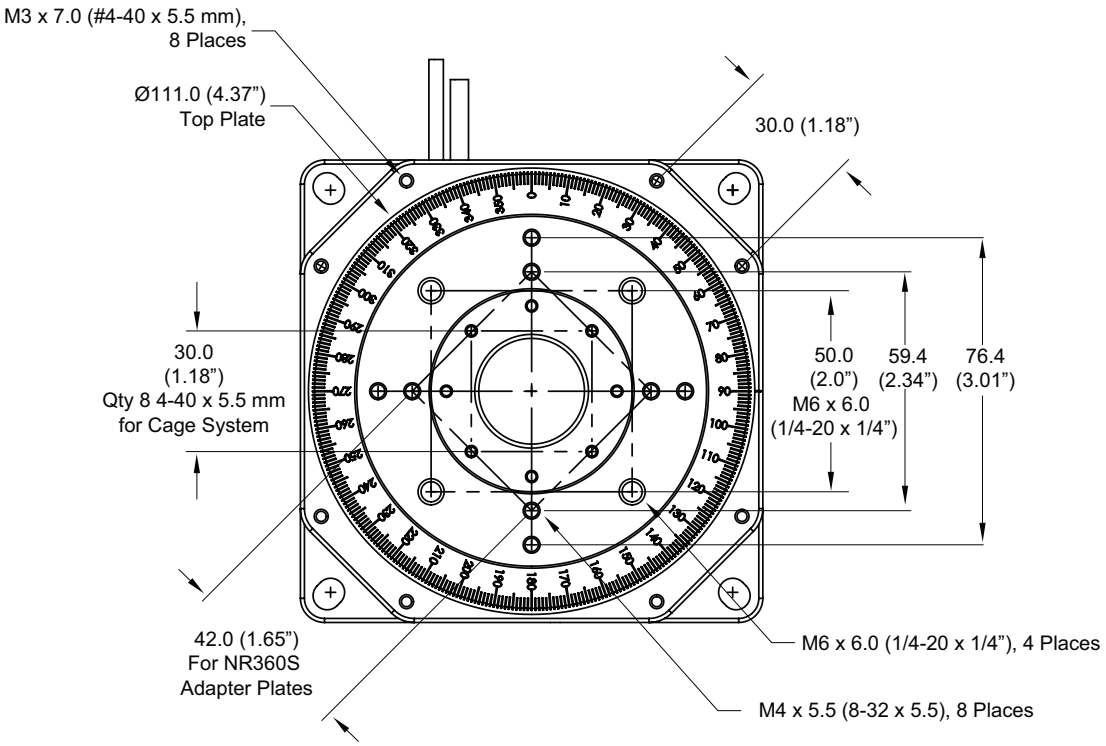


Fig. 3.10 Top Plate Detail

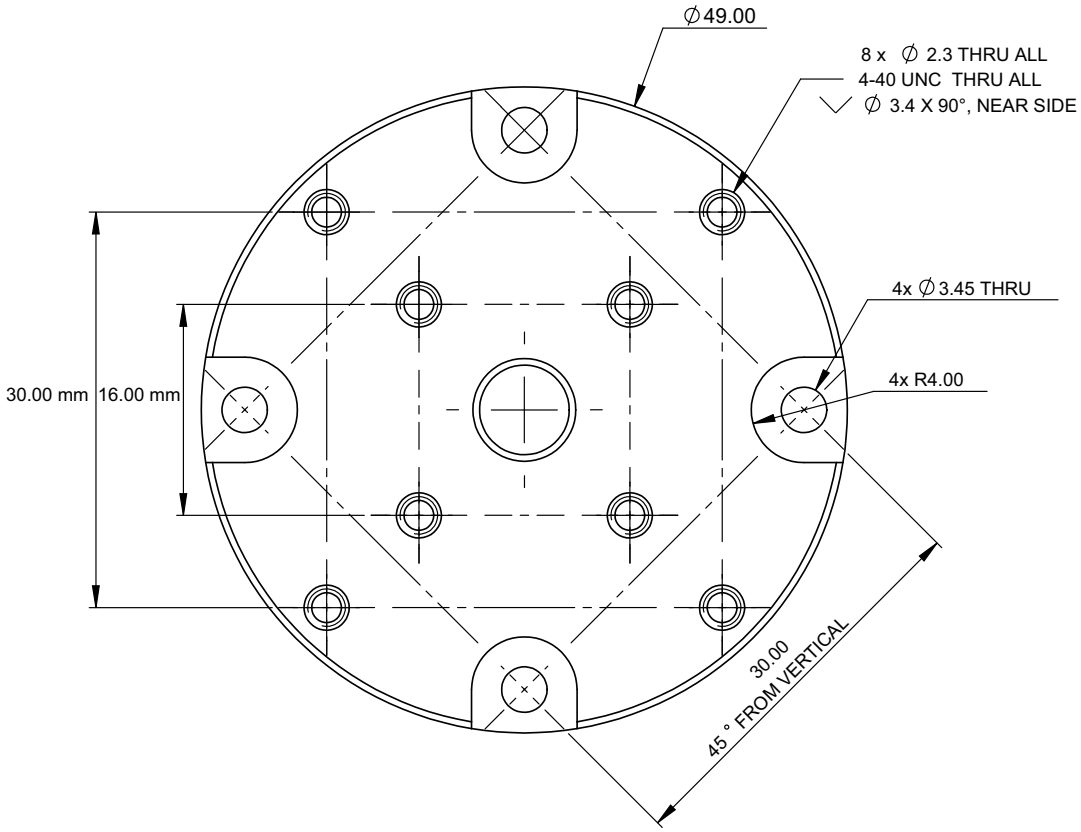


Fig. 3.11 Center Insert Details

Chapter 4 Operation Using Kinesis Software

4.1 General

Caution

The DDR100 stage is designed to be driven by the Thorlabs BBD series Brushless DC Motor Controllers.

Keep clear of the moving world when the unit is in operation and rotating with equipment attached to the top plate.

The stages are connected to the controller via 2 flying leads, one terminated in D-type connector (FEEDBACK) and one terminated in a round 8-Pin DIN Connector (MOTOR DRIVE).

Warning

The motor 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.

When running custom move sequences, or under fault conditions, the stage may move unexpectedly. Operators should take care when working inside the moving envelope of the stage.

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

1) Make electrical connections as detailed in Section 3.4.
2) Manually position the moving platform to be around its central position.

Warning

3-phase brushless DC motors are commutated electronically, i.e. the controller drives the coils with a precisely controlled waveform, that depends on the position of the motor coil housing. On power up, the position of the coil housing is not known. The controller establishes this by energising the coils and measuring the resulting movement. This is why on power up, the stage (motor) may make a slight buzzing noise and move slightly. Phase initialisation can only take place if the motor can move unobstructed during this time. Before powering up the BBD controller at item (2), ensure that the stage movement is unobstructed.

3) Power up the BBD controller and wait until the Channel Enable LEDs start flashing (approx 3 seconds).
4) Run the Kinesis and click the 'Home' button on each GUI panel. When homing is complete, the Channel Enable LEDs stop flashing.

Note

The need for homing comes from the fact that on power up the motor (stage) is at a random position, so the value of the position counter is meaningless. Homing involves moving the motor to a known reference marker and resetting the position counter to the associated absolute value. This reference marker can be one of the limit switches or can be provided by some other signal. The DDR100 stages use an optical reference marker and therefore the limit switches are not used for reference.

5) The stage can now be moved using the joystick, GUI panel, or by setting commands to move each axis by relative and absolute amounts – see the handbook supplied with the BBD controller, and the helpfile supplied with the Kinesis software for more information.

Note

There are two position reporting modes. The displayed position is dependent on the mode selected - see Section 4.3. for more details.

6) The stage is shipped already loaded with default parameter settings, which should give satisfactory performance in most cases for loads up to 2.0 kg (4.4 lb). However, depending on the application and load, it may be necessary to adjust the PID loop parameter settings to fine tune the response - see the following pages for more information.
7) If it is not already running, start the Kinesis 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..

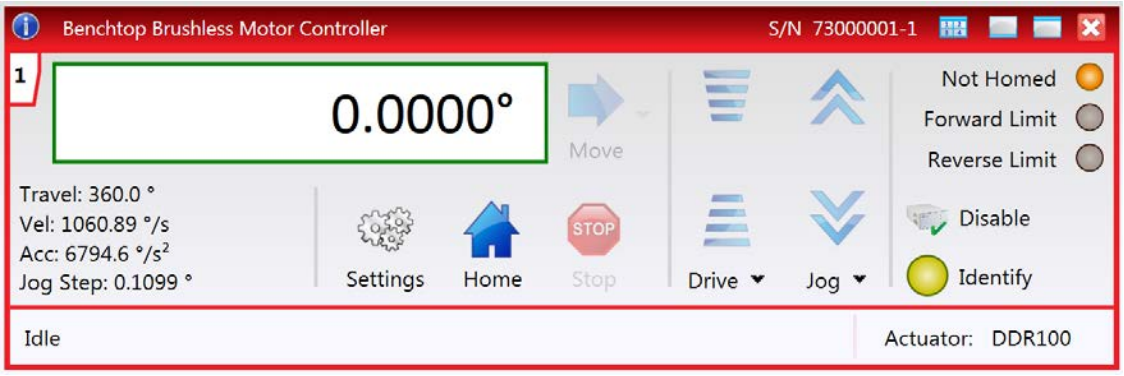


Fig. 4.1 Kinesis GUI screen

Note

The MOTOR DRIVE connectors for each channel/axis contain an EEPROM, which stores the factory default settings for the set up parameters. When the stage is connected, these settings are loaded into the controller on start up, and are tuned for loads up to the 2.0 kg (4.4lb) maximum, at speeds up to 180 rpm.

However, depending on the load being driven and the speed/duty cycle of the particular application, it may be necessary to further optimize the Position PID loop settings.

If problems are encountered (e.g. stability of the closed loop position control, lost motion or incomplete moves) the position loop PID parameters should be adjusted to tune the stage for the given application. Normally, only minor adjustment of the Proportional, Integral and Derivative parameters should be necessary, and some trial and error will be required before the ideal settings for a specific application are achieved. In cases where further adjustment of the control loop parameters is required, the following guidelines are provided in order to assist in the tuning process.

8) Click the Settings button on the GUI to display the Settings panel, then select the 'Advanced' tab.

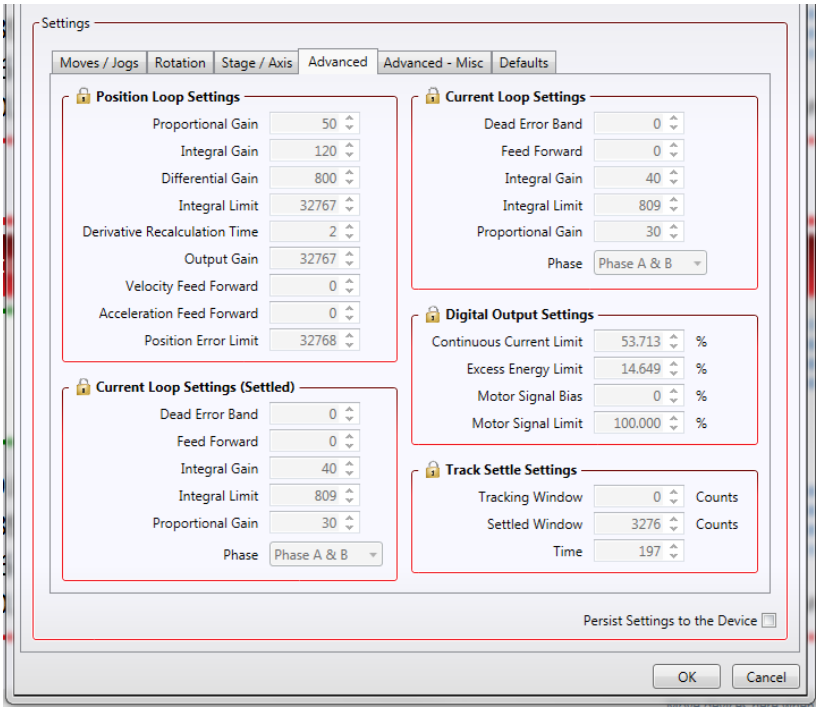


Fig. 4.2 Advanced Control Loop Settings

9) Adjust the PID settings to fine tune the control loop for your application. Refer to the handbook supplied with the BBD series control unit for more information.

10) After the parameter changes have been performed, click the 'Persist Settings to Hardware' box, 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.

See the manual supplied with the BBD series controller unit for more information.

Note

Position PID Settings Summary

Stage overshoots the intended position - reduce the integral term, and increase the derivative and proportional terms.

Stage fails to attain final position - increase the integral and proportional terms.

Motion is unstable - reduce the proportional and integral terms, increase the derivative term.

Stage sounds noisy - reduce the derivative term.

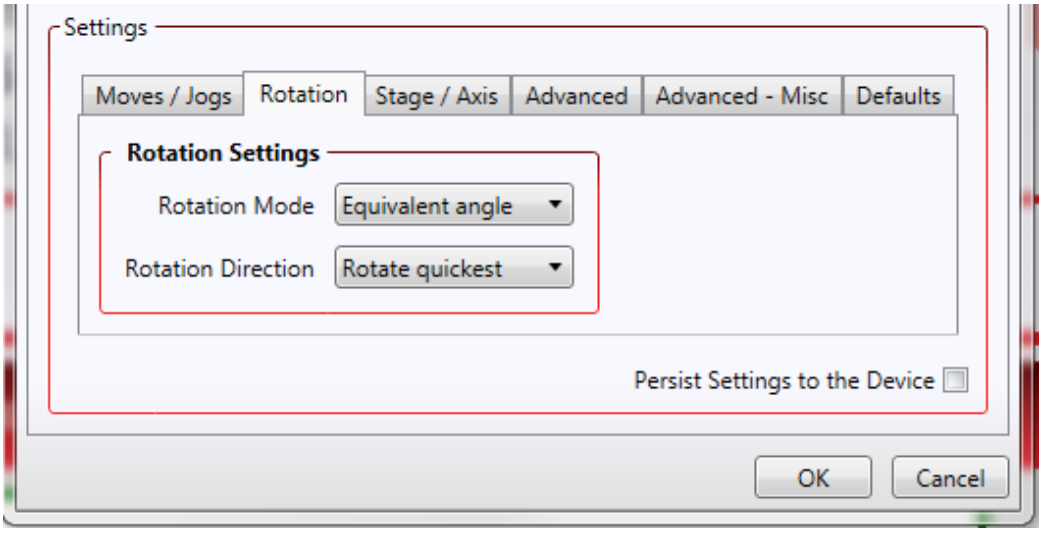
Please see the handbook supplied with the controller, for more information on changing these settings

4.2 Minimum and Maximum Position Settings

There are no mechanical end stops on the DDR100 stage and theoretically, the total (accumulative) angle of the motion could be arbitrarily large. In practice, however, the integer arithmetic used for the position counter poses a restriction on the range of position values that can be represented. To avoid integer overflow and underflow problems, the target position is checked against the limits displayed in the Min Pos and Max Pos values. This check is done to ensure that the position counter always shows a correct value. For the DDR100 stage, the Min Pos and Max Pos limits are equivalent to ±655 full rotations (235,800 degrees).

In applications where continuous rotation is required, the Move At Velocity command can be used. This command does not constrain the angle to the Min Pos and Max Pos range and the continuity of the movement will not be interrupted until a Stop command is issued. However, when the integer representing the position counter overflows, the position value will flip sign and will no longer be correct. Any application commanding continuous moves for long period of times must take this into account and accept that once the Min Pos and Max Pos position is exceeded, the value displayed may no longer be correct.

4.3 Rotational Stage 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 – 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°.

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

Panel Display Rotation Move Mode

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

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 Stopping the Stage

The drive channel is enabled by clicking the 'Enable' button on the GUI panel, and disabled using the 'Disable' button. Disabling the channel removes the drive power.

During operation, the stage can be stopped at any time by clicking the 'Stop' button on the GUI panel. Using this button does not remove power to the drive channel. .

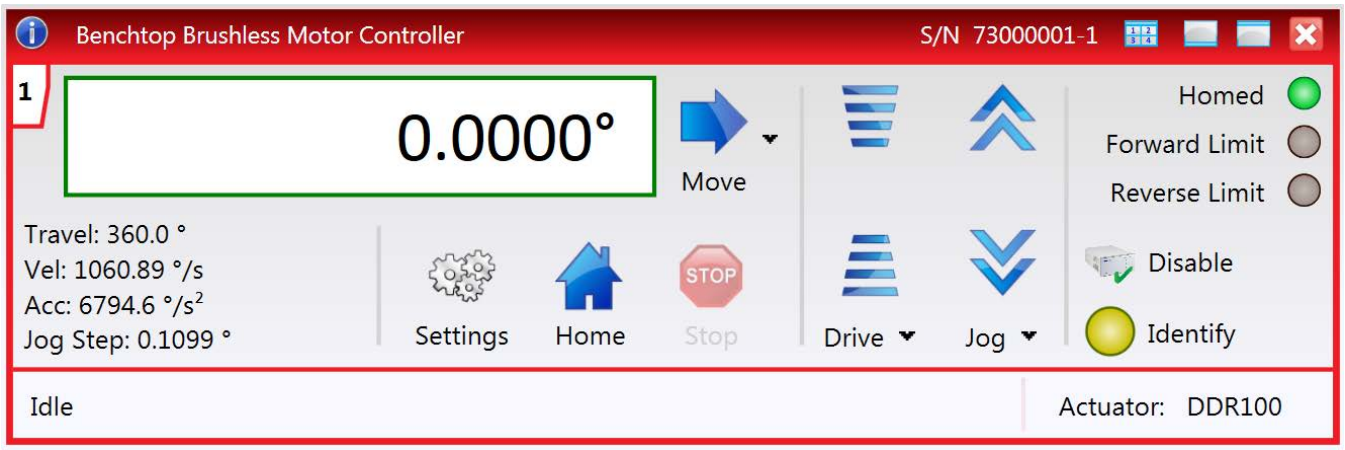


Fig. 4.3 Kinesis GUI screen

Position Error Messages.

Caution

The maximum velocity at which the encoder can operate is 180 rpm. Above this speed, encoder pulses may be lost and, as a result, the position readout becomes incorrect. This renders normal operation impossible because phase commutation of the motor is also based on the encoder reading.

When the stage is controlled by the BBD controller, the maximum velocity is limited to safe values. However, if the output is disabled (with the controller connected and monitoring the position) and the stage is moved manually at high speeds (i.e. above 180 rpm), it is possible to exceed this limit. If the BBD controller is subsequently used again to move the stage, the incorrect encoder reading will cause incorrect operation, often resulting in sudden uncontrolled moves. It is therefore important not to move the stage excessively quickly when it is moved manually.

The BBD controller has fault monitoring to detect the loss of encoder pulses. If this fault occurs, an error message will be generated and the controller must be powered down and re-started so that correct phasing and commutation can be established.

4.5 Maintenance

The product is maintenance free up to 8,000 hours of intermittent operation. If any problems occur, the user should contact the local Thorlabs tech support for more information. After 8,000 hours, the bearing may need to be re-lubricated. Contact your local Thorlabs tech support for more information.

4.6 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.

The unit has fragile internal components that can be damaged if the staged is dropped.

4.7 Troubleshooting

If an unexpected obstruction to the stage motion is encountered, the control system interface software disables the current to the associated drive channel, which may or may not result in the channel being disabled. After the obstruction to be removed, the associated channel of the controller should first be disabled to clear any fault codes, then re-enabled. In the event of a breakdown, or malfunction of the product please contact Thorlabs Tech Support. Contact details are contained in Chapter .

Chapter 5 Operation Using APT Software

5.1 General

Caution

The DDR100 stage is designed to be driven by the Thorlabs BBD series Brushless DC Motor Controllers.

Keep clear of the moving world when the unit is in operation and rotating with equipment attached to the top plate.

The stages are connected to the controller via 2 flying leads, one terminated in D-type connector (FEEDBACK) and one terminated in a round 8-Pin DIN Connector (MOTOR DRIVE).

Warning

The motor 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.

When running custom move sequences, or under fault conditions, the stage may move unexpectedly. Operators should take care when working inside the moving envelope of the stage.

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

1) Make electrical connections as detailed in Section 3.4.
2) Manually position the moving platform to be around its central position.

Warning

3-phase brushless DC motors are commutated electronically, i.e. the controller drives the coils with a precisely controlled waveform, that depends on the position of the motor coil housing. On power up, the position of the coil housing is not known. The controller establishes this by energising the coils and measuring the resulting movement. This is why on power up, the stage (motor) may make a slight buzzing noise and move slightly. Phase initialisation can only take place if the motor can move unobstructed during this time. Before powering up the BBD controller at item (2), ensure that the stage movement is unobstructed.

3) Power up the BBD controller and wait until the Channel Enable LEDs start flashing (approx 3 seconds).
4) Run the APTUser utility and click the ‘Home’ button on each GUI panel. When homing is complete, the Channel Enable LEDs stop flashing.

Note

The need for homing comes from the fact that on power up the motor (stage) is at a random position, so the value of the position counter is meaningless. Homing involves moving the motor to a known reference marker and resetting the position counter to the associated absolute value. This reference marker can be one of the limit switches or can be provided by some other signal. The DDR100 stages use an optical reference marker and therefore the limit switches are not used for reference.

5) The stage can now be moved using the joystick, GUI panel, or by setting commands to move each axis by relative and absolute amounts – see the handbook supplied with the BBD controller, and the helpfile supplied with the APT server for more information.

Note

There are two position reporting modes. The displayed position is dependent on the mode selected - see Section 4.3. for more details.

6) The stage is shipped already loaded with default parameter settings, which should give satisfactory performance in most cases for loads up to 2.0 kg (4.4 lb). However, depending on the application and load, it may be necessary to adjust the PID loop parameter settings to fine tune the response - see the following pages for more information.

7) If it is not already running, 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..

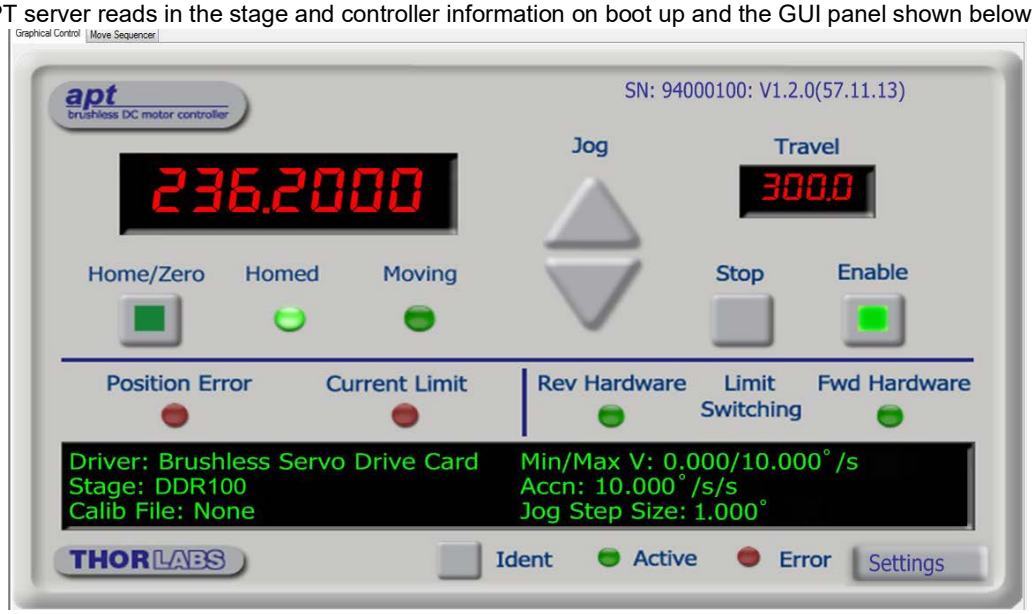


Fig. 5.1 APTUser GUI screen

Note

The MOTOR DRIVE connectors for each channel/axis contain an EEPROM, which stores the factory default settings for the set up parameters. When the stage is connected, these settings are loaded into the controller on start up, and are tuned for loads up to the 2.0 kg (4.4lb) maximum, at speeds up to 180 rpm.

However, depending on the load being driven and the speed/duty cycle of the particular application, it may be necessary to further optimize the Position PID loop settings.

If problems are encountered (e.g. stability of the closed loop position control, lost motion or incomplete moves) the position loop PID parameters should be adjusted to tune the stage for the given application. Normally, only minor adjustment of the Proportional, Integral and Derivative parameters should be necessary, and some trial and error will be required before the ideal settings for a specific application are achieved. In cases where further adjustment of the control loop parameters is required, the following guidelines are provided in order to assist in the tuning process.

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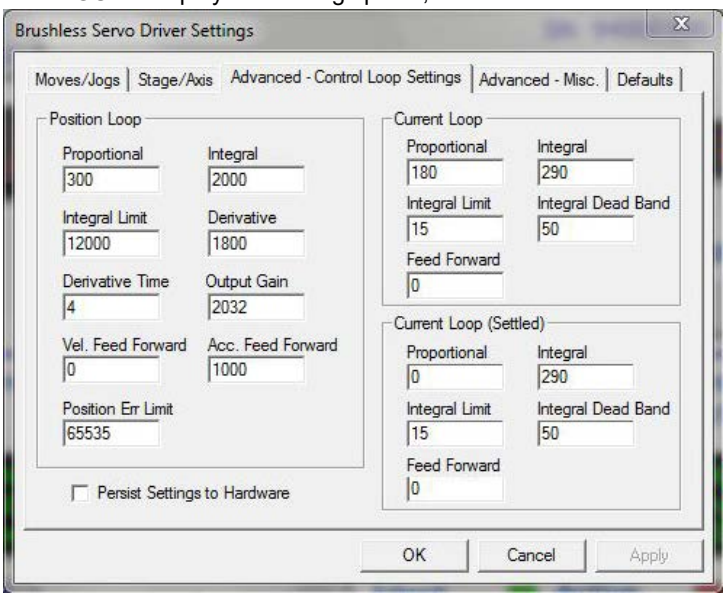


Fig. 5.2 Advanced Control Loop Settings

9) Adjust the PID settings to fine tune the control loop for your application. Refer to the handbook supplied with the BBD series control unit for more information.
10) After the parameter changes have been performed, click the 'Persist Settings to Hardware' box, 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.

See the manual supplied with the BBD series controller unit for more information.

Note

Position PID Settings Summary

Stage overshoots the intended position - reduce the integral term, and increase the derivative and proportional terms.

Stage fails to attain final position - increase the integral and proportional terms.

Motion is unstable - reduce the proportional and integral terms, increase the derivative term.

Stage sounds noisy - reduce the derivative term.

Please see the handbook supplied with the controller, for more information on changing these settings

5.2 Minimum and Maximum Position Settings

There are no mechanical end stops on the DDR100 stage and theoretically, the total (accumulative) angle of the motion could be arbitrarily large. In practice, however, the integer arithmetic used for the position counter poses a restriction on the range of position values that can be represented. To avoid integer overflow and underflow problems, the target position is checked against the limits displayed in the Min Pos and Max Pos values. This check is done to ensure that the position counter always shows a correct value. For the DDR100 stage, the Min Pos and Max Pos limits are equivalent to ±655 full rotations (235,800 degrees).

In applications where continuous rotation is required, the Move At Velocity command can be used. This command does not constrain the angle to the Min Pos and Max Pos range and the continuity of the movement will not be interrupted until a Stop command is issued. However, when the integer representing the position counter overflows, the position value will flip sign and will no longer be correct. Any application commanding continuous moves for long period of times must take this into account and accept that once the Min Pos and Max Pos position is exceeded, the value displayed may no longer be correct.

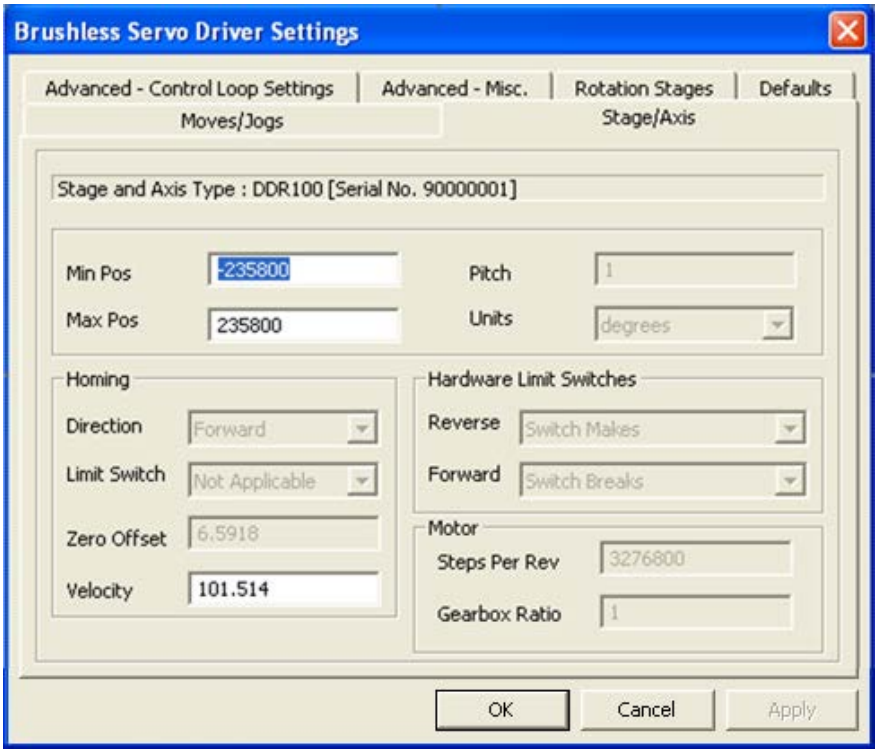
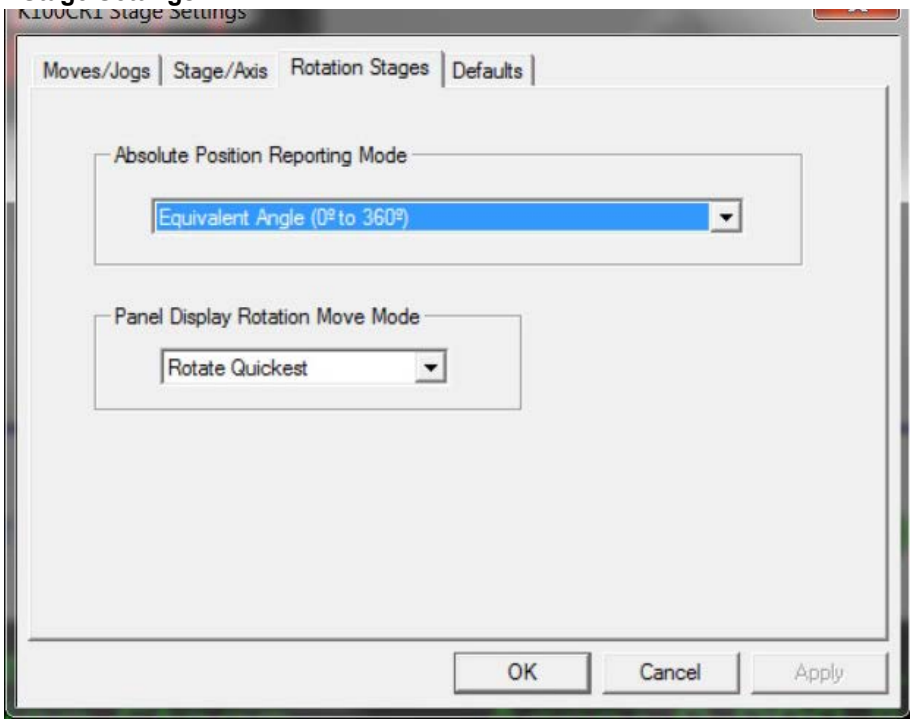


Fig. 5.3 DDR100 Stage/Axis Settings Tab

5.3 Rotational Stage 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

5.4 Stopping the Stage

The drive channel is enabled and disabled by clicking the 'Enable' button on the GUI panel. The green indicator in the button center is lit when the drive channel is enabled. Disabling the channel removes the drive power.

During operation, the stage can be stopped at any time by clicking the 'Stop' button on the GUI panel. Using this button does not remove power to the drive channel. .

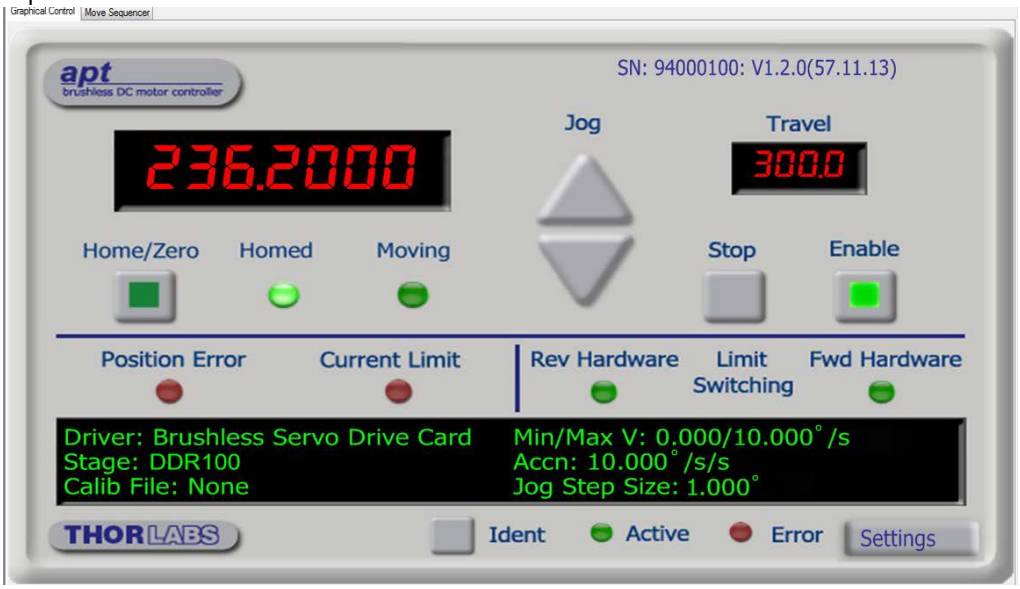


Fig. 5.4 APTUser GUI screen

Position Error Messages.

Caution

The maximum velocity at which the encoder can operate is 180 rpm. Above this speed, encoder pulses may be lost and, as a result, the position readout becomes incorrect. This renders normal operation impossible because phase commutation of the motor is also based on the encoder reading.

When the stage is controlled by the BBD controller, the maximum velocity is limited to safe values. However, if the output is disabled (with the controller connected and monitoring the position) and the stage is moved manually at high speeds (i.e. above 180 rpm), it is possible to exceed this limit. If the BBD controller is subsequently used again to move the stage, the incorrect encoder reading will cause incorrect operation, often resulting in sudden uncontrolled moves. It is therefore important not to move the stage excessively quickly when it is moved manually.

The BBD controller has fault monitoring to detect the loss of encoder pulses. If this fault occurs, an error message will be generated and the controller must be powered down and re-started so that correct phasing and commutation can be established.

5.5 Maintenance

The product is maintenance free and must be returned to the factory for service or repair. If any problems occur, the user should contact the local Thorlabs tech support for more information.

5.6 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.

The unit has fragile internal components that can be damaged if the staged is dropped.

5.7 Troubleshooting

If an unexpected obstruction to the stage motion is encountered, the control system interface software disables the current to the associated drive channel, which may or may not result in the channel being disabled. After the obstruction to be removed, the associated channel of the controller should first be disabled to clear any fault codes, then re-enabled. In the event of a breakdown, or malfunction of the product please contact Thorlabs Tech Support. Contact details are contained in Appendix H.

Chapter 6 Specifications

6.1 Specification

Parameter	Value
Travel Range	360° Continuous
Max Speed	180 rpm (3 Hz)
Max Acceleration[a]	7200°/s^2 at 0.5 kg (1.1 lb) Load
Bidirectional Repeatability	60 µRad
Backlash[b]	N/A
Encoder Resolution	2.0 µRad
Min Achievable Incremental Movement	70.0 µrad
Maximum Horizontal Load Capacity[a]	5.0 kg
Maximum Vertical Load Capacity[a]	2.0 kg (Mounted Centrally)
Absolute On-Axis Accuracy (Average)	250 µRad
Burst Torque (1 Sec)	0.7 N•m
Continuous Torque	0.5 N•m
Settling Time	200 ms typical
Velocity Stability	0.5%
Max Wobble (Axial)[c]	60 µrad
Bearing Type	4-point Cross Roller Bearing
Limit Switches	None
Central Aperture	SM1 Threaded
Operating Temperature Range[d]	5 to 40°C (41 to 104°F)
Motor Type	Slotless Brushless DC Rotary Motor
Cable Length	3 m (9.8')
Dimensions (L x W x H))	115 mm x 115 mm x 40 mm (4.53 x 4.53” x 1.58”)
Weight (Excluding cables)	2 kg (4.4 lb)

Note

[a] The acceleration is limited by the peak torque of the stage (0.7 Nm). Lighter loads can accelerate faster while heavier loads accelerate slower. In test conditions, an acceleration of 7200°/s^2 was achieved with a load of 0.5 kg (1.1 lb), while the typical acceleration for a 2 kg (4.4 lb) load is 1800°/s^2. The controller default PID parameters are set for load up to 2.0 kg and may require adjustment for higher loads.

[b] The stage does not suffer from backlash because there is no leadscrew.

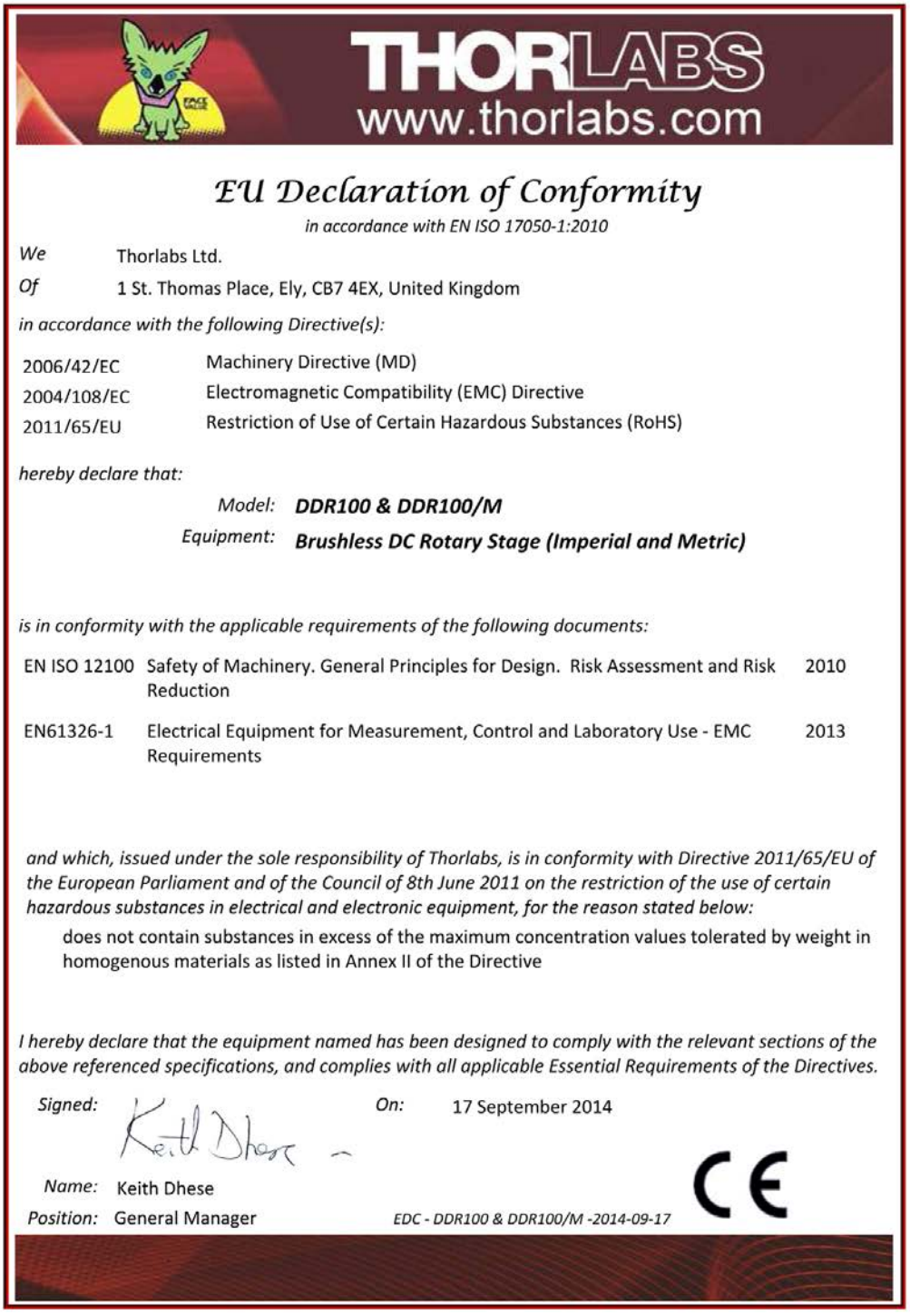
[c] At 50° per sec

[d] For operation at temperatures outside normal room temperature, the PID parameters may require optimization.

Chapter 7 Regulatory

7.1 Declarations Of Conformity

7.1.1 For Customers in Europe



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: ***DDR100 & DDR100/M***

Equipment: ***Brushless DC Rotary Stage (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
EN61326-1	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:* 17 September 2014

Name: Keith Dhese

Position: General Manager

CE

EDC - DDR100 & DDR100/M -2014-09-17

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, 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.

Appendix H 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.

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Japan
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sales@thorlabs.jp

UK and Ireland
Thorlabs Ltd.
sales@uk.thorlabs.com
techsupport.uk@thorlabs.com

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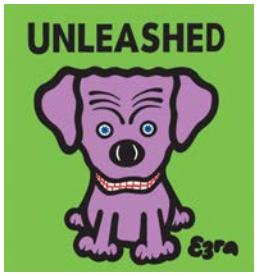
scandinavia@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

China
Thorlabs China
chinasales@thorlabs.com

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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