

# ODL220(/M), ODL300(/M), ODL600(/M) Optical Delay Lines

**User Guide** 



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# Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
$\sim$	Alternating Current
$\sim$	Both Direct and Alternating Current
Ť	Earth Ground Terminal
	Protective Conductor Terminal
+	Frame or Chassis Terminal
$\mathbf{A}$	Equipotentiality
	On (Supply)
0	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
<u>A</u>	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

# Chapter 2 Safety

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.



	CAUTION	
Only apply a s	small clamping force when tightening the screws that hold the right-angle prism mirror.	

WARNING WARNING When aligning laser beams on this system, remember to wear appropriate laser safety glasses.

# Chapter 3 Introduction

Thorlabs' ODL220(/M), ODL300(/M), and ODL600(/M) Free-Space Optical Delay Line Kits incorporate a longtravel, low-profile direct drive stage, benchtop controller, and optics for tuning the optical delay. Optical delays up to 4000 ps (ODL600) and repeatable delay shifts down to 0.67 femtoseconds are achievable. The high accuracy and long-term stability of the stage make this system a suitable choice for pump-probe spectroscopy, THz spectroscopy, interferometry, and related applications. For accommodating different input beam heights, Thorlabs offers the RS99 Periscope Assembly (sold separately), which can accept a maximum beam height of approx. 4.6" (114 mm) with the included Ø1" Pillar Post. By using additional Ø1" Posts, the input beam height that can be accommodated is easily increased to any height.

The stage's V-block contains features two kinematic mirror mounts and positions for two ring-actuated irises for alignment. Two Ø1" ultrafast-enhanced silver mirrors (UM10-AG) as well as a 1" knife-edge right-angle prism with a protected silver coating (MRAK25-P01) are included. The knife-edge prism is mounted on one end of the translation stage. These mirrors provide high reflectance and minimal group delay, making them well suited for use with femtosecond pulsed lasers.



Figure 1 Assembled ODL300 Optical Delay Line Kit

# Chapter 4 Setup and Alignment

#### WARNING

Infrared laser beams are particularly dangerous because they cannot be seen. Always wear appropriate laser safety glasses (not included) when working with laser beams.

Each kit includes a direct drive translation stage, a V-block with two built-in kinematic adjusters, two MH25 Mirror Holders for attaching mirrors to the V-block, two SM05D5D Ring-Actuated Irises, two removable FT-SM05 Mounting Bases for attaching the irises to the V-block, two Ø1" UM10-AG Ultrafast Mirrors, an MRAK25-P01 Protected-Silver-Coated, Knife-Edge Right-Angle Prism, a platform riser, a fixed riser plate and prism mirror mount, and a BBD301 Benchtop Controller for the translation stage. Figure 2, below, shows an assembled ODL300 kit and beam path after the system has been aligned.



Figure 2 Schematic of an Optical Delay Line Kit

### 4.1. Optical Assembly



Figure 3 Component Locations

### 4.1.1. Delay Stage, Part 1: V-Block

- 1. Mount the platform riser plate onto the movable stage platform with the three included 1/4"-20 (M6) cap screws.
- 2. Mount the V-block to the platform riser plate. It fastens down using three 8-32 button head cap screws, which are provided (BH8A025). In order to center the V-block on the stage, the open end of the "V" should point towards the 90 degree prism. Place the three screws in the mounting holes and move the V-Block in order to align the holes, then tighten the screws.
- 3. Mount two Ø1" mirrors into the MH25 mirror holders by inserting the bottom of the mirror into the externally threaded side of the adapter, then tightening the knurled ring around the bottom piece. (To remove the mirror later, a SPW901 adjustable spanner wrench, sold separately, may be necessary to provide torque.)
- 4. Thread the mounted mirrors into the kinematic mounts on the V-block.

### 4.1.2. Delay Stage, Part 2: Prism Mount



Figure 4 Mounting the Stage Riser and Knife-Edge Prism

- 1. Mount the stage riser to the side of the translation stage. It attaches using two of the included 1/4"-20 (M6) cap screws.
- 2. Install the knife-edge right-angle prism into its holder. The two legs of the right-angle prism are gently pressed against the edges of the specially designed holder, and the top plate of the holder is gently tightened against the prism by three locking screws with a 5/64" hex head.

#### 4.1.3. Final Assembly

- 1. At this point, the translation stage may be secured to the optical table or breadboard using 1/4"-20 (M6) cap screws secured using the slots in the ends of the stage.
- Thread the two SM05D5D irises into the FT-SM05 bases. The irises are externally SM05 (0.535"-40) threaded for compatibility with the FT-SM05 bases, which are internally SM05 threaded. The irises may be located either on the prism holder or on the V-block, as needed for alignment.
- 3. Using the irises and the V-block's built-in kinematic mirror mounts, ensure that both passes of the beam along the stage's translation axis are parallel to the stage translation and each other over the entire range of travel.
  - a. The V-block is machined to position the mirrors at close to their optimal positions. Only small adjustments should be necessary.
  - b. To facilitate quick alignment, the power to the translation stage should be off. This allows the stage to freely move. Under software control the stage may also be released for this purpose.
  - c. To align the first pass, move the translating plate as close as possible to the prism, and tweak the adjusters of the top mirror to center the beam on the first iris. Then move the translating plate as far as possible from the prism and tweak the adjusters of the bottom mirror to center the beam on the first iris.
  - d. To align the second pass, move the translating plate as far as possible from the prism, and tweak the adjusters on the first mirror of the V-block to center the beam on the second iris. Then move the translating plate as close as possible to the prism, tweak the adjusters on the second mirror of the V-block to center the beam on the second iris.
  - e. If the stage alignment is correct, and the beam spot is observed on a screen after the second reflection from the right-angle prism, the spot will not move as the stage is translated.
- 4. Connect the stage and power supply to the BBD301 controller then use the included USB cable to connect the BBD301 to your PC.



#### 4.2. Optical Delay Offsets

Figure 5 Minimum Optical Delay Path

When the stage is at zero position there is an inherent minimum optical delay in the system. This delay is a fixed distance. The delays listed below need to be taken into account when calculating the overall delay.

- a. ODL220(/M) Inherent Delay @ 0 mm Position: 152 mm or 507 ps.
- b. ODL300(/M) Inherent Delay @ 0 mm Position: 182 mm or 607 ps.
- c. ODL600(/M) Inherent Delay @ 0 mm Position: 182 mm or 607 ps.

### 4.3. Beam Entrance Height







Figure 7 DDS300(/M) Beam Entrance Height



Figure 8 DDS600(/M) Beam Entrance Height

# Chapter 5 Software Control

The optical delay line may be controlled using the Kinesis<sup>™</sup> software package, which includes graphical user interface utilities for direct interaction and provides out-of-the-box control of the stage. Kinesis also provides a set of programming interfaces that allow custom integrated positioning and alignment solutions to be easily programmed in the development language of your choice.

Using Kinesis, you can read the current stage position; control the stage position, speed, and acceleration; and execute scan sequences. With this software, it is possible to precisely choose the optical delay you wish to add or subtract from your beam path. For interferometry or pump-probe experiments, the option to scan the stage continuously or in discrete steps with each step's position being held for a specific time period is available. Refer to the following guide for more detailed information on the use of the Kinesis software: **BBD301, BBD302, & BBD303 Brushless DC Motor Controllers Kinesis User Guide**.

The Kinesis software may be downloaded directly from our website (http://www.thorlabs.com/) by choosing Services > Software Downloads > Motion Controllers > Kinesis Overview.

### 5.1. Software Operation

The Kinesis software suite includes a graphical user interface. The following provides a brief tutorial of the operation of the stage using the GUI controls, as well as an introduction to parameters that can be configured through the GUI. This chapter assumes that the stage, controller, and computer are connected and powered up as described in Section 3.5 of the **BBD301**, **BBD302**, **& BBD303 Brushless DC Motor Controllers Kinesis User Guide**, and that the software is already installed. The DDS220 Direct Drive Translation stage was used to demonstrate operation.

1	Benchtop Brushless Motor G	ontroller				S/N 103	191064-1 — 🗆 🗙
1	110.00000 mm		Move	Ŧ	*	Homed O Forward Limit O	
Trav Vel: Acc Jog	vel: 220.0 mm : 100 mm/s :: 1000.02 mm/s <sup>2</sup> Step: 2.2 mm	्र्िक्षे Settings	Home	<b>Stop</b>	Drive •	V Jog •	Disable
Idl	e						Actuator: DDS220

Figure 9 Kinesis Software Operational Panel

Thorlabs' Kinesis Software Main Panel consists of all operations required for the delay line. Optical delay in the stage is double pass and provides the following range:

- ODL220(/M) Travel/Delay Range: 0 to 220 mm or 0 ps to 1470 ps
- ODL300(/M) Travel/Delay Range: 0 to 300 mm or 0 ps to 2000 ps
- ODL600(/M) Travel/Delay Range: 0 to 600 mm or 0 ps to 4000 ps

#### 5.1.1. Settings Panel

When the 'Settings' button on the GUI panel is clicked, the 'Settings' window is displayed. This panel allows motor operation parameters such as move/jog velocities, and stage/axis information to be modified. Note that each of these settings also can be read and updated using the Kinesis API. Chapter 7 of the **BBD301**, **BBD302**, **& BBD303 Brushless DC Motor Controllers Kinesis User Guide**, provides more information about the Kinesis API, including a table that associates Kinesis API commands with the Kinesis GUI functionality.

🖏 Settings	– 🗆 X
Base Unit BBD30X Current Startup	
Channel 1 DDS220 This shows the settings that are currently active in the devia DDS220 DDS220	ce.
Moves / Jogs Stage / Axis Advanced Advanced - M	isc Defaults
Position Display Use Device Units Units mm  Factor 1.0 Decimal Places Auto  Options	Jog Step Size 15.0068 mm Mode Jog mm Stop Profiled Maximum Velocity 100.0015 mm/s Acceleration 1000 mm/s <sup>2</sup>
Velocity     100 🖍 mm/s       Maximum Velocity     100 🖍 mm/s       Acceleration     1000 🖍 mm/s <sup>2</sup>	Backlash Distance
Enable Restricted Settings	Persist Settings to the Device
	OK Cancel

Figure 10 Settings Panel (Move/Jog)

- **Velocity** These variables may also be changed to the stage: velocity and acceleration. During a scan, high speed steps may produce a ringing motion at stop that can be removed by slowing down the acceleration and velocity.
- **Jog** Sets the distance the stage will move in either direction when the jog arrows are invoked by a mouse click.
- **Position Display** All motion distances may be addressed in millimeters or picoseconds. The user can change the Position Display units as described in the next section.
- **Backlash** All motion distances may be addressed in millimeters or picoseconds. The user can change the Position Display units as described in the next section.

#### 5.1.2. Position Display Parameters

By default, the GUI will display position in mm. If required, the units can be changed so that the display shows other positional units (cm, µm, or in.). Refer to section 6.4 of the **BBD301, BBD302, & BBD303 Brushless DC Motor Controllers Kinesis User Guide** for a more detailed description. The follow will describe how to setup a custom unit to display the positioning in picoseconds.

Custom units can be added to the drop-down "Units" menu. To do this, click the "Options" button to open the "Configure Custom Units" window. Enter the name of the custom unit in the "Unit Name" field and adjust the factor to the value necessary to convert from millimeters to the new custom unit. Then click add. When finished click OK. The new custom unit can now be selected from the Units drop-down menu. window.

Enter ps for the new units, and a factor of 6.67 for conversion from millimeters to picoseconds, then click Add.

isplay Units		
Unit	Factor	
ps	6.67	
Unit Name	ps	
Unit Name Factor	ps 6.67 🗢	

Figure 11 Configure Custom Units

### 5.2. Control Functions

Using Kinesis, the ODL has 3 options to promote a move over any part of the stage.

- a. **Direct ODL Control** is a graphical user interface utility for direct interaction and provides out-ofthe-box control of the stage.
- b. **External Triggered Scan** promotes a scan after a 5V trigger is invoked at the BNC connector on the rear panel of the BBD301 Controller.
- c. **Internal Triggered Sequence** promotes a scan after the Run Sequence is invoked. Scans from Ref 1 to Ref 2 by Delay Dwell time and Scan Step Size. Upon completion of the scan a 5V CMOS pulse is generated at USER IO connector (Pin 3) on the BBD301 Controller. Refer to the BBD301 manual for connector identification.

When the Software/Controller/stage is powered on, it is required that the stage is homed to determine absolute zero.

#### 5.2.1. Direct ODL Control

The display shows continuously the stage position in the units selected above.

1	Benchtop Brushless Motor Co	ontroller				S/N 103	191064-1 — 🗆 🗙
1	733.00000 ps			Move	T	*	Homed O Forward Limit O Reverse Limit
Trav Vel: Acc Jog	vel: 1466.0 ps : 666.36 ps/s :: 6663.79 ps/s <sup>2</sup> Step: 99.9999 ps	දරුණි Settings	Home	<b>Stop</b>	Drive 🕶	V Jog 🗸	Disable
Idl	e						Actuator: DDS220

Figure 12 DS220 Homed

- **Move** Opens the move settings window. Enter the target position and make any desired modifications to velocity and acceleration parameters. To move to the specified position, click the blue arrow to the right of the position entry field. The current values of the Move function's velocity and acceleration parameters are also shown below the left corner of the Position window.
- **Home** Involves moving the motor to a known reference marker and resetting the position counter to the associated absolute value.
- **Jog** Allows the user to enable a jog move. The jog move step size is set by the user on the Settings panel.
- **Drive** Used to increment or decrement motor position. These eight controls are arranged as a bar graph. The controls in the top and bottom groupings increment and decrement the stage position, respectively. Clicking each bar in a group moves the stage at a different velocity, the speed of which is related to the length of the bar. To change any of the four velocity settings, click the button labeled with "Drive" and a down arrow. Note that the velocities can be entered in any order. However, they will be automatically reordered from largest to smallest before being assigned to the controls
- Stage Disable/Enable Once the stage is energized it is locked in position. One can enable or disable the stage so one can move the stage by hand to some arbitrary position. Once the stage is energized it is locked in position. One can enable or disable the stage so one can move the stage by hand to some arbitrary position.

#### 5.2.2. External Triggered Scan

The ODL controller can be configured so that it responds to the Trigger In signal, provided via the BNC port, by homing the stage, moving the stage by a relative amount, or moving the stage to a specified absolute position. The rising or falling edge of a Trigger In signal initiates the action. The rising edge refers to a transition from logic LOW to HIGH, and the falling edge refers to a transition from logic HIGH to LOW. Since a move already in progress will not be interrupted, the stage will not respond to an external Trigger In signal if in the process of executing a move.

# Refer to the Triggering section of the BBD301, BBD302, & BBD303 Brushless DC Motor Controllers Kinesis User Guide.

The trigger settings can be used to configure multiple units in a master-slave setup, thereby allowing multiple channels of motion to be synchronized. Multiple moves can then be initiated via a single software or hardware trigger command.

Input triggers are coupled to the BBD30x controllers via a BNC connector on the rear panel of the unit. There is one BNC connector devoted to each channel supported by the controller. Note that on the BBD301, the I/O 1 port is used for Trigger In and the I/O 2 port is non-functional. The output trigger signal is provided via pin 13 (User Digital O/P 10+) on the 37-pin AUX I/O connector on the unit's rear panel.

#### 5.2.3. Internal Triggered Sequence

The sequencer is useful for automating tasks on one or more devices. It allows the user to run a set of simple tasks on a device or to create a program of events to control several devices in a synchronized manner. An example of how a sequence is created and run is provided below.

This sequence will Home the stage, and then move the stage to zero. Once the stage is at zero position, an output trigger will be raised, and the stage then waits for a time set by the user. Once the wait time has expired, the stage will move relative to its current position by an amount set by the user. After each relative move an output trigger is raised and a user defined wait is invoked. This relative move is repeated by a number determined by the user.

📌 1 Event		
-	Benchtop Brushless Motor Controller 103191064-1	Actuator DDS220
.≱*1.	Home	
المي 2.	Move To	
ى 3.	Set Digital Output	
ا الح	Wait	
ى 😓 3.	Repeat	
يچ 👌	Move Relative	
ا.2. ک	Digital Output Pulse	
الله المراجع ا	Wait	
ا ئ	Define Name Tag	

Figure 13 Example Sequence

#### Creating A Sequence

Click the Sequence Manager button, on the right-hand side of the main Kinesis window. This opens the sequence manager task pane. Click the New option to create a new sequence.



Figure 14 Create Sequence

The new unedited sequence is displayed in a small window within the Sequence Manager task pane. This task pane can display multiple sequences for multiple devices at any one time allowing easy access and control for multiple devices and sequences.

To add devices and functions to a sequence click the **Edit** button in the new sequence window.



Figure 15 Edit Sequence

A larger Sequence Editor window will open, where devices and functions can be added to the sequence.

😍 Edit Sequence		
Sequence Untitled	Description <ul> <li>The Sequence comprises of a number of events which are run in order. The following Events can be defined.</li> <li>Device Event: This allows sub sequences to be defined for 1 or more Devices. All sub sequences are completed before this event completes.</li> <li>Wait Event: This allows the sequence to be held for a defined period of time.</li> <li>Name Tag: This allows a point in the sequence to be defined. This can be used when defining a Repeat Event.</li> <li>Repeat Event: This allows a section of the sequence to be repeated 1 or more timed. Use the Name Tag to help define the section.</li> <li>Pause Event: This allows the sequence to be paused until resumed by the user.</li> </ul>	Save Save As Start Run
	Event List	
	Copy    Second S	
	Logging Options	Close

Figure 16 Sequence Editor

A sequence is comprised of several events which are run in order. To insert a currently connected device into the sequence event, click Insert over to the right, and from the subsequent drop-down list select Device Event, see below. This allows a sub sequence to be defined for 1 or more devices.

Description     The Sequence comprises of a number of events which are run in order.     following Events can be defined.     Device Event: This allows sub sequences to be defined for 1 or more D     sub sequences are completed before this event completes.     Wait Event: This allows a point in the sequence to be defined. This can     Name Tag: This allows a point in the sequence to be defined.	The Ovices. All	Save
when defining a Repeat Event. Repeat Event: This allows a section of the sequence to be repeated 1 of timed. Use the Name Tag to help define the section. Pause Event: This allows the sequence to be paused until resumed by Event List Name Detail Paulo End	be used or more the user.	Save As
✓     ✓	Copy Paste	Close
	turded. Use the Name Tag to help define the section. Pause Event: This allows the sequence to be paused until resumed by Event List   Event List	turned. Use the Name Tag to help define the section. Pause Event: This allows the sequence to be paused until resumed by the user. Event List Vame Detail End End Cut Cut Cut Cut Copy Cut Device event Copy Cut Paste

Figure 17 Insert Device Event

The device event will now be displayed on the left-hand side of the sequence window (1 Event below). Select the new event by clicking it. This will allow you to access devices to add to the sequence event.

Sequence Modified	Untitled
ک <sup>*</sup> 1 Event	6
👜 End	

Figure 18 Select Device Event

To add a connected device to the new event, click **Add**. This will display all the currently connected and loaded devices. Select the device you would like to add to the sequence from the drop-down menu. Devices are named and identified by their unique serial number.

	Event	
Name	Event	
Description		
escription		
This sec When the This Eve completed	tion allows Device Sequences to be ad iis Event is actioned, each Device Sequ nt will not complete until all Device Se ed.	ded to the Sequence. ence will run in parallel. quences have been
evice		
Device		🤹 Edit
		=
		Remove
		🔧 Cut
		Сору
		Danta
鍌 Add 🔻		
Benchte	064-1 p Brushless Motor Controller	
4		-

Figure 19 Add Device Event

Once the device is added select the device from the main sequence window on the left-hand side by clicking on it as shown below.

Sequence	Untitled		]
• rioaquea			]
🐉 1 Event		<ul> <li>•</li> </ul>	
-	Benchtop Brushless Motor Controller 103191064-1	Actuator DDS220	
End			]
-			

Figure 20 Select Device

The window displayed allows you to insert details and functions that you would like your device to perform during the sequence.

To home the motor as the first step in the sequence, click **Insert**, then select **Home** from the drop-down list. This will add a home command to the sequence.

	10319106 Benchtop DDS220	54-1 Brushless Motor Controller	
Descript Ad Ea Se	ion d Device spe ch Device Eve quence runni	cific Events to the current Device Sequence. ent will be run in sequence, in isolation to any ong.	other Device
Current	Actions		
Index	Function	Detail	Edit
🃚 Ins	ert 👻		Paste
Solution	ert 👻	Home	Paste

Figure 21 Insert Home Command

Once the device has homed a new function can be added after the Home step to move the device to a new set position.

To ensure that this move occurs after the Home step highlight the **Index 2** action in the **Current Actions** list; this will insert the next sequence step immediately before the End of the sequence. (All new sequence events are added immediately before the currently selected action.)

ndex	Function	Detail	🌏 🕹 Edit
3 1	Home		
æ 2			📚 Remove
			🗙 Cut
			Сору
			😤 Paste

Figure 22 Insert Next Command

To add a simple move command to the sequence, click **Insert** then select the **MoveTo** function.



Figure 23 Insert Move To Command

To edit the parameters of the move double click on the **MoveTo** step in the **Current Actions** List. This will open a section that will allow the user to edit the position that the motor will move to, see below.

Function	Move To					
Description	Move the Motor to the specified position.					
	This function will move the Motor to the specified position. If a Rotational Stage is fitted, then the limits are defined by the Rotation Mode.					
Parameters						
	Position 0 🗢 ps					

Figure 24 Move To Parameters

To add the next command to the sequence, click **Insert** then select the **I/O Set Digital Output** function.

ndex	Function	Detail	🎭 Edit
1 🐟	Home		Cy Luit
<u>ک</u> * 2	Move To	0 ps	🐟 Remove
			🗙 Cut
			📬 Сору
			🚰 Paste
🃚 Inse	ert 💌		
🃚 Inse Actio	ert 👻	•	
Set Pa	ert 👻 n 🛛 🖬	•	
Actio Set Pa Contr	ert ¥ n I arameters I	•	
Set Pa Contr I/O	ert <b>v</b> n arameters rol	Set Digital Output	*

Figure 25 Set Digital Output

To edit the parameters of the set digital output click on the **Set Digital Output** step in the **Current Actions** List. This will open a section that will allow the user to edit the I/O Port State, see below.

Function					
Function	Set Digital Output				
Description	Set the I/O output to High or Low.				
	This function will set the I/O Port output. I/O Port: The I/O port to be updated (Omitted if only one port available I/O Port State: Set the Port to High or Low.				
Parameters					
	I/O Port state High Y				

Figure 26 Move To Parameters

To add the next command to the sequence, click **Insert** then select the **Control Wait** function.

0 ps	▶ 1 Home ▶ 2 Move To 0 ps	ITIGEA	Function		Detail	🗫 Edit
0 ps	🔎 2 Move To 0 ps	ه 1	Home			Car Luit
Kemove		2 🍫	Move 1	Го	0 ps	<b>S</b> 0
utput I High	3 Set Digital Output 1 High	3ء 🏕	Set Dig	ital Output	1 High	Kemove
	Cut	🃚 Inse	rt 💌			🚔 Copy
ିଲ୍ଲ Copy 😤 Paste	≥ Cut ⇒ Copy Sector Sector	Action		•		
Copy	≥ Cut ⇒ Copy Sector → Action →	Set Par	rameters	•		
Copy	Cut Copy Paste Set Parameters		.1	I 00	Message	-
Copy Copy Log Message	Corpy	Contro	וכ	Log	-	
Log Message Define Name Tag	Cut  Cut  Cut  Copy  Control  Log Message  Control  Con	Contro I/O	21	<ul> <li>Defi</li> </ul>	ne Name Tag	-
		₩.				
Kemove	The Departure	2 🌾	Move 1	Го	0 ps	S Pamana
0 ps Semove	📌 2 Move To 0 ps 📫 👘	index ا ه	Function Home		Detail	🏇 Edit

Figure 27 Wait

To edit the parameters of the wait click on the **Wait** step in the **Current Actions** List. This will open a section that will allow the user to edit the Wait State, see below.

Function	Wait					
Description	Wait for the specified duration.					
	This function will hold the device in it's current state for the specified duration.					
Parameters						
	Wait Time 00:00:01 000					

Figure 28 Wait Parameters

To add the next command to the sequence, click Insert then select the Control Repeat function.

ndex	Function		Detail			a Edit
ء 😓	Home					Luit
2 🏕	Move To	D	0 ps		-	
3ء 🏕	Set Digi	tal Output	1 High		9	Remove
4 衫	Wait		00:01.000			
چ 🕉					0	Cut
						Сору
					1 2	Paste
				 	2	Paste
a Ince	art ¥			 		Paste
🦫 Inse	ert 🕶			 		Paste
S Inse Action	ert 💌	•				Paste
Set Pa	ert 👻	•				Paste
Set Pa	ert 👻	•				Paste
Set Pa Contr	ert 👻 n arameters ol	<ul> <li>Log N</li> </ul>	Nessage			Paste
Set Pa Contro I/O	ert 👻 n arameters ol	<ul> <li>Log N</li> <li>Defin</li> </ul>	Nessage e Name Tag			Paste
Action Set Pa Contro I/O	ert 👻 n arameters ol	<ul> <li>Log N</li> <li>Defin</li> <li>Repei</li> </ul>	Nessage e Name Tag at			Paste
Action Set Pa Contr I/O	ert V arameters ol	<ul> <li>Log N</li> <li>Defin</li> <li>Reper</li> </ul>	Message e Name Tag at			Paste

Figure 29 Repeat

To edit the parameters of the repeat click on the **Repeat** step in the **Current Actions** List. This will open a section that will allow the user to edit the Number of time to repeat the steps inserted after the repeat function until the end of the sequence, see below.

Function				
Function	Repeat			
Description	Implements a repeat block			
	A Repeat Action allows a section in the sequence to be repeated 1 or more times. The Repeat Action can repeat from the end of the sequence or from a Name Tag.			
Parameters				
	nt 10 🚔 常			
Repeat Cour	10 🗸			

Figure 30 Wait Parameters

To add the next command to the sequence, click **Insert** then select the **Action Move Relative** function.

Index	Function	Detail	📩 Edit
ء 😓	Home		Se Lon
کې 🎲	Move To	0 ps	
کې 🏕	Set Digital	Output 1 High	es Remove
ه 🌮	Wait	00:01.000	=
5 🎻	Repeat	1 * End	Cut
۵¢			
			Copy
			639
			Paste
Solution	ert 🕶	Home	
Action Set Pa	ert ¥	Home Jog	
Action Set Pa Contro	ert 👻 arameters 🕨 ol 🕨	Home Jog Jog (At Velocity)	
Action Set Pa Contro I/O	ert <b>v</b>	Home Jog Jog (At Velocity) Move Continuous	*
Action Set Pa Contro I/O	arameters ) Next	Home Jog Jog (At Velocity) Move Continuous Move Continuous (At Velocity)	Back
Action Set Pa Contro I/O	ert V	Home Jog Jog (At Velocity) Move Continuous Move Continuous (At Velocity) Move Relative	Back
Action Set Pa Contro I/O	ert V arameters > ol > FVEXE	Home Jog Jog (At Velocity) Move Continuous Move Continuous (At Velocity) Move Relative	Back
Control I/O	ert ¥ h  h arameters h h h h h h h h h h h h h h h h h h h	Home Jog Jog (At Velocity) Move Continuous Move Continuous (At Velocity) Move Relative Move Re Move the Motor by a defined Move To	Back
Set Pa Contro I/O	ert ¥	Home Jog Jog (At Velocity) Move Continuous Move Continuous (At Velocity) Move Relative Move Re Move the Motor by a defined Move To Move To	Back distance.

Figure 31 Move Relative

To edit the parameters of the move relative click on the **Move Relative** step in the **Current Actions** List. This will open a section that will allow the user to edit the Move distance parameter, see below.

Function	Move Relative				
Description	Move the Motor by a defined distance.				
	This function	will Move the	Motor by the defined distance and direction		
Parameters M	ove distance	10	0 🗢 🎽 ps		
Mo	ove Direction	Forward	The relative move distance		

Figure 32 Move Distance Parameter

To finish the example sequence we will use the copy and paste feature of the sequence editor. Highlight the Index 3 "Set Digital Output" step and paste it into the sequence below the Index 5.1 "Move Relative" step. Repeat this for the Index 4 step "Wait" to complete the example sequence.

Index	Function	Detail	🎭 Edit
1 😓	Home		J 2011
چ 😓	Move To	0 ps	<b>1</b>
ک 🕹	Set Digital Output	1 High	Remove
ه 👌	Wait	00:01.000	-
5 🐟	Repeat	10 * End	🔏 Cut
5.1 🌛	Move Relative	15.006821282401099594445447	
5.2 🧼			Сору
			Copy the selected Device Event
			and rasie

Figure 33 Copy

ndex Function	Detail	the Edit	
1 Home		Cart	
2 Move To	0 ps	-	
3 Set Digital Out	put 1 High	Remove	
🗼 4 🛛 Wait	00:01.000		
5 Repeat	10 * End	🔏 Cut	
5.1 Move Relative	e 15.0068212824010995944454474;		
3 5.2		Сору	
		(A)	
		Paste	

Figure 34 Paste

The sequence can now be saved, select the **Save As** button on the right of the Sequence editor window.



Figure 35 Save As

The sequence can now be saved with a suitable file name. The files are saved as .sequence files. Click **Save**. Once back on the main sequence editor window click **Close** to close the sequence editor window.



Figure 36 Close Editor

#### Running A Sequence

To run the newly saved sequence, click the Run button in the sequence manager task pane. The system executes the <u>sequence created</u> previously.



Figure 37

# Chapter 6 Specifications

### 6.1. Kit Contents

Item #	ODL220(/M)	ODL300(/M)	ODL600(/M)
Translation Stage	DDS220(/M) Stage	DDS300(/M) Stage	DDS600(/M) Stage
Controller	BBD301 Benchtop Controller		
Optics	UM10-AG Mirror (Qty. 2), MRAK25-P01 Knife-Edge Prism		
Optic Mounts	Retroreflector V-Block, Knife-Edge Prism Mount		
Adaptara	Platform and Stage Risers	Platform and Stage Risers	Platform and Stage Risers
Auapters	for DDS220(/M) Stage	for DDS300(/M) Stage	for DDS600(/M) Stage
Alignment Irises	SM05D5D Lever-Actuated Iris (Qty. 2)		
Iris Mounts	FT-SM05 FiberBench Optic Mount (Qty. 2)		

### 6.2. Optical Delay Line Specifications

Item #	ODL220(/M)	ODL300(/M)	ODL600(/M)
Maximum Optical Delay	1470 ps	2000 ps	4000 ps
Inherent Delay @ 0 mm	507 ps	607 ps	607 ps
Delay Sensitivity <sup>a</sup>	0.67 fs	0.67 fs	0.67 fs
Output Beam Height	3.22" (81.7 mm)	3.45" (87.7 mm)	3.45" (87.7 mm)

a. Based on the minimum repeatable incremental motion of the stage.

### 6.3. Key Translation Stage Specifications

Item #	DDS220(/M)	DDS300(/M)	DDS600(/M)
Travel Range	220 mm (8.6")	300 mm (11.81")	600 mm (23.6")
Speed (Max)	300 mm/s	400 mm/s	400 mm/s
Acceleration (Max)	5 000 mm/s²	10 000 mm/s²	10 000 mm/s²
Bidirectional Repeatability	±0.25 µm		
Incremental Movement (Min)	0.1 µm		
Absolute On-Axis Accuracy	±2.0 μm	±7.5 μm	±12.0 μm
Pitch <sup>b</sup>	±175 µrad	±100 µrad	±150 µrad
Yaw <sup>b</sup>	±175 μrad	±150 µrad	±300 µrad
Bearing Type	Precision Linear Bearing	High Rigidity, Recirculating, Precision Linear Bearings	
Motor Type	Brushless DC Linear Motor		
Dimensions	370.0 mm x 90.0 mm x 44.0 mm (14.57" x 3.54" x 1.73")	500 mm x 130 mm x 50 mm (19.69" x 5.12" x 1.97")	800 mm x 130 mm x 50 mm (31.5" x 5.12" x 1.97")
Weight	Weight 2.4 kg (5.3 lbs)		9.1 kg (20.0 lbs)

a. Component specifications are subject to change. Please refer to our website for complete and up-to-date translation stage specifications.

b. Pitch and yaw are measured by moving the stage over its full travel range and taking an angular robust laser interferometry (RLI) measurement at 20 equidistant points along the travel. This is repeated 10 times and the maximum discrepancy between minimum and maximum value in the pitch and yaw directions is taken.

## 6.4. Key Controller Specifications

Item #	BBD301
Control Algorithm	16-Bit Digital PID Servo Loop with
	Velocity and Acceleration Feedforward
Velocity Profile	Trapezoidal/S-Curve
Position Feedback	Incremental Encoder
Encoder Bandwidth	2.5 MHz (10 M Counts/s)
	Power: 250 VA
Input Power	Voltage: 100 to 240 V AC
Requirements	Frequency: 47 to 63 Hz
	Fuse: 3.15 A
Dimonsions	199.8 mm x 229.1 mm x 108.8 mm
Dimensions	(7.87" x 9.02" x 4.28")

a. Refer to our website for complete controller specifications.

# Chapter 7 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out "wheelie bin" logo (see right)
- 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

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 Thorlabs 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 Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

#### Waste Treatment is Your Own Responsibility

If you do not return an "end of life" unit to Thorlabs, 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.

#### 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.



Wheelie Bin Logo

# Chapter 8 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at <u>www.thorlabs.com/contact</u> 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

Thorlabs Japan, Inc. sales@thorlabs.jp

#### UK and Ireland

Thorlabs Ltd. sales.uk@thorlabs.com techsupport.uk@thorlabs.com

#### Scandinavia

Thorlabs Sweden AB scandinavia@thorlabs.com

## Brazil

Thorlabs Vendas de Fotônicos Ltda. brasil@thorlabs.com

#### China

Thorlabs China chinasales@thorlabs.com

