Pattern Player[™] version 1.2.0 Description of Operations



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Introduction:

Pattern Player[™] is a rapid-communication voltage pattern player software program for use with AgilOptics deformable membranes. It allows quick creation, adjustment, and playing of voltage patterns, causing an AgilOptics mirror to simulate a series of prescribed shapes.

Important Definitions:

<u>frame</u> -	A frame represents a single voltage pattern that has been placed on the deformable mirror.
<u>movie</u> -	A series of frames being played out by Pattern Player on a deformable mirror.
pattern file -	A file consisting of a series of voltage patterns.
<u>sequence</u> -	The order of voltage patterns in a pattern file or movie.
<u>voltage pattern</u> -	A series of voltages that, when placed on a deformable mirror, cause it to take on a prescribed shape.
<u>GUI</u> -	GUI stands for Graphical User Interface. The GUI consists of all the various buttons, selectors, and displays that the user can interact with.



Patterns and Pattern Playback Explained:

Each pattern for the deformable mirror (DM) consists of a series of voltages. Each voltage represents how strongly the DM is pulled to the actuator pad. The stronger the voltage, the more the DM is pulled. When a voltage pattern is placed on the DM, the deformable mirror takes on the shape of that pattern.

A pattern file contains one or more patterns, in series. When a pattern file is played, each pattern in that file is placed on the mirror, in order. The pattern remains on the mirror for a number of milliseconds equal to the Pattern Delay value on the main GUI. Once the time for one pattern is up, the next pattern is placed on the mirror. Once all the patterns have been played, Pattern Player loops back to the first pattern and plays it again. In this way, the patterns are played continuously.



8 Pattern play loop



Pattern Player Startup GUI:

Drop Down Box for Mirror Selection



When Pattern Player starts, it has a very simple-looking interface. The two main features are the mirror selection drop down box and the mirror driver drop down box. Use these to select the mirror and driver you are using. If you are unsure as to which driver to select, use D64USB if you are connecting to your mirror via USB, or D40DI if you are connecting via the parallel port.



Pattern Player Main GUI:

After the mirror and driver are selected, Pattern Player reveals a few more options:

Loaded	💷 Pattern Player	Loaded Driver
Mirror	Exit Pattern Sequence Browser Help	1
	Mirror Driver	
	50-61 Rectangular D40DI	
	Actuator Map File Name = Select Mirror and Driver	
	Pattern File Name = C:\Documents and Settings\Da Browse	
2. General Pattern	Pattern Width = 61 Pattern Length = 1	
Manipulation	Save Working Pattern	1. Current Pattern
\geq	Average Voltage	File
	Minimum Voltage	8. Save Working
	Pattern Max Voltage 345 ^{Mirror Max Voltage} 300.000	Pattern
	Statt Delayable Patterns Mode Pattern Delay = 10.000 🗄 ms	
/		
3. Start / Stop	Patterns 4. Mode Selection	

5. Pattern Sequence Browser

- 1. Current Pattern File The current patterns that Pattern Player will send to the mirror.
- 2. General Pattern Manipulation Controls the average and minimum voltage of all of the patterns currently loaded. Understand that the focus of the membrane is approximately the average voltage on all actuators. Adjust the average voltage to change the focus of all of the patterns. Adjust the minimum to increase or decrease the strength of the patterns. Decreasing the minimum flattens the patterns, while increasing the minimum makes the patterns more extreme. The Reset buttons set the Average or Minimum voltages back to their original values.
- 3. Start / Stop Patterns Starts and stops the current pattern file running on the mirror.



- 4. Mode Selection Choose between *Delayable Patterns Mode*, where a time delay may be used between each pattern and *Fast Patterns Mode*, a mode that writes all the patterns to the mirror as fast as possible. Some slowdown may occur in *Fast Patterns Mode* between full pattern sets. Even with this slowdown, *Fast Patterns Mode* is MUCH faster than *Delayable Patterns Mode*. *Fast Patterns Mode*'s extra speed is dependent upon the processor speed of the computer running Pattern Player.
- 5. Pattern Sequence Browser If you'd like to look at the currently loaded pattern file and make changes, use the Pattern Sequence Browser.
- 6. Pattern Width How many actuators the pattern tries to set voltages to.
- 7. Pattern Length The number of patterns in the current pattern file.
- 8. Save Working Pattern Allows the user to save the current patterns with any changes made to the patterns from the Average Voltage and Minimum Voltage sliders.



Pattern Sequence Browser:

The Pattern Sequence Browser lets you edit the voltages in your current pattern file, adding, removing, or changing the existing patterns to fit your needs.



- A. Pattern File and Mirror Manipulation Options:
 - 1. Pattern File Name The name of the currently loaded pattern file.

2. Pattern Set Name –	The name of the pattern set.
3. Set Mirror Voltages –	Writes the current pattern from the Pattern Sequence Browser to the first pattern on the Mirror.
4. Get Mirror Voltages –	Reads the current pattern from the Mirror and displays it on the Pattern Sequence Browser.
5. Save File –	Save any alterations made to the currently loaded pattern file.



B. Pattern Editing Options:

- 1. Editable Pattern The editable pattern can be set as one of the existing patterns by double-clicking on the name the existing pattern in the *list of patterns*.
- 2. Add Pattern Add the current editable pattern to the end of the *list of patterns*. The name of the new pattern is just above the Add Pattern button.
- 3. Replace Selected Pattern Replaces the pattern selected in the *list of patterns* box with the current editable pattern.
- 4. Move Pattern Up Move the currently selected pattern towards the front of the *list of patterns* by one pattern.
- 5. Move Pattern Down Move the currently selected pattern towards the back of the *list of patterns* by one pattern.
- 6. Delete Pattern Remove the currently selected pattern from the *list of patterns*.

C. Pattern Playback Review:

- 1. Play / Stop Start / Stop playing through the patterns in the *list of patterns*. These patterns are played visually only, and no voltages are written to the mirror.
- 2. Scroll Bar Use the scroll bar to look through the patterns quickly.
- 3. Continuously Loop When in play mode, whether or not reaching the end signifies stopping play mode.

D. Color Bar:

Right-click on the color bar and choose "Hide Control Panel" to hide the Pattern Sequence Browser Control Panel.



E. Pattern Sequence Browser Control Panel:

The Pattern Sequence Browser Control Panel gives you a lot more flexibility in altering existing voltage patterns or creating new ones.



E-1. Currently Selected Channel

Control Panel Controls:

- 1. Channel The currently selected channel voltages the user is manipulating.
- 2. Voltage Scroll Bar Scroll through voltages on the current channel from the minimum on the left to the maximum on the right.
- 3. Zero All Zero all voltages on the mirror display.
- 4. Step The voltage amount increase or decreased when using mouse controls on the mirror display.
- 5. Set All Set all channels on the mirror to the voltage specified.



- 6. Right-mouse click The right mouse button, when used over an actuator image, decreases the voltage on that actuator by the Voltage Step Size.
- 7. Left-mouse click The left mouse button, when used over an actuator image, increases the voltage on that actuator by the Voltage Step Size.
- 8. Middle-mouse click The middle mouse button, when used over an actuator image, sets that actuator to zero volts.



Instructions for Changing an Aeri Pattern:

Changing an Aeri pattern and then running it with Pattern Player requires a few careful steps:

1. Open the Pattern Sequence Browser. The Pattern Sequence Browser can be found at the top of the Pattern Player main GUI, as seen in the picture below.

Pattern	Sequence	Browser

W Pattern Player	
Exit Pattern Sequence Browser Help	
Mirror	Driver
50-61 Rectangular	D40DI
Actuator Map File Name = Selec	at Mirror and Driver
Pattern File Name = C:\Docume	nts and Settings\Da Browse

2. Load the pattern file you wish to use by finding it with Browse in the Pattern Sequence Browser.

Browse Button

Exit		
Pattern File Name = C:\Document a Browse	hannel 61	50-61 Rectangular
Pattern Set Name = Default Pattern Name	Voltage	0.0
Set Mirror Voltages Get Mirror Voltages Save File	Zero All Step = 10.000	- Set All = 0.0
List of Patterns		1
0P0 1 0PD 2 0PD 3 0PD 4 0PD 5 0PD 6 0PD 6 0PD 7 0PD 8 0PD 9 0PD 9 0PD 9		2237 - 2307 2537 - 2537 - 2337 - 2337 - 1357 2537 - 2537 - 2537 - 2537 - 2557 2537 - 2507 - 2507 - 2507 - 2507



3. Select the pattern you wish to change by double-clicking on it from the list of patterns.



4. Edit the pattern on the mirror display in the Pattern Sequence Browser. Left-clicking on an actuator adds the step voltage to that actuator's voltage. Right-clicking on an actuator subtracts the step voltage from the actuator's voltage. Pressing the middle mouse button while on an actuator sets that actuator's voltage to 0. Follow guidelines in section E.





5. Once you have the new pattern you want, add it to the list or replace it on the list of voltage patterns.

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	Patien File Name + C-\Documents a Boerse	Channel 61 -
	Pattern Set Name = Default Patterns Name	Voltage
	Set Minor Voltages Get Minor Voltages Save File	Zen Al Step = 10.000
	List of Patterns	
Add Pattern	0070 1 0070 2 0070 2 0070 5 0070 5 0070 5 0070 7 0070 8 0070 8 0070 8 0070 8 0070 8 0070 8 0070 1 0070 1	47
and	Selected Pattern: 0	
Replace	Move Pattern Up Move Pattern Down	
Pattern \	Delete Pattern	Minor Diameter: 0.050m
	Ediable Paflerx	W.
>	Add Pattern	Play 4
(Perdens Schederd Putters) Contractively Loop

- 6. Repeat steps 2 through 4 for each pattern you wish to alter.
- 7. Save the pattern in the Pattern Sequence Browser.

	1 Default Patterns Name Pattern Sequence Browser	
	Exit	
Save -	Pattern File Name = C\Documents a Browse Channel 61 -	1
Dottorn	Pattern Set Name - Default Patterns Name Voltage	1
Fallem	Set Mirror Voltages Get Mirror Voltages Save File	
	List of Patterns	6
	OPD 1 OPD 2 OPD 3 OPD 4 OPD 5 OPD 6 OPD 7 OPD 7 OPD 9 OPD 9 OPD 10 OPD 11	



8. Exit the Pattern Sequence Browser.



9. Load the pattern in Pattern Player.

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Mirror	Driver	Br	aswo
50-61 Rectangular	• D40DI		atter
Actuator Map File Name = Sel	ect Mirror and Driver	Fil	e to lo
Pattern File Name = C\Docum	ents and Settings\Da	Browse	a ioac
Pattern Width = 61	Pattern Length	=	
Save Wo	rking Pattern		
Average Voltage	161.6	Reset	
Minimum Voltage	0.0	Reset	
Pattern Max Voltage 34	EMirror Max Voltage 300.000	÷	
Start Delayable Patterns Mo	de Pattern Delay = 10.0	00 ÷ ms	

10. To alter the speed your patter will run at, change the pattern delay. This can be done while the pattern is running.

Por Forcess pedagance provider Deb	
Mirror	Driver
50-61 Rectangular	D40DI
Actuator Map File Name = Sele	ct Mirror and Driver
Pattern File Name = C:\Docume	nts and Settings\Da Browse
Pattern Width = 61	Pattern Length = 1
Save Work	ing Pattern
Average Voltage	161.6 V Reset Patte
Minimum Voltage	0.0 Reset Dela
Pattern Max Voltage 348	Mirror Max Voltage 300.000
Start Delayable Patterns Mod	Pattern Delay = 10 000 + ms



11. Your new pattern should now be ready for you to run in Pattern Player. Press "Start" to run it.

	M Pattern Player			
	Exit Pattern Sequence Browser Help			
	Mirror	Driver		
	50-61 Rectangular	D40DI _		
	Actuator Map File Name = Selec	t Mirror and Driver		
	Pattern File Name = C.\Documents and Settings\Da Browse			
	Pattern Width = 61	Pattern Length = 1		
start the	Save Working Pattern			
oaded	Average Voltage	161.6 .V Reset		
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he DM.	Pattern Max Voltage 34EMirror Max Voltage 300.000			
(Start Delayable Patterns Mode	Pattern Delay = 10.000 1 ms		
	Stan Delayable Patterns Mode	Pattern Delay = 10.000 g ms		



Frequently Asked Questions (FAQ):

- **1. How do I make patterns from scratch?** See Appendix 1 for a detailed walkthrough on creating your own pattern files.
- 2. Can I advance frames one at a time? When using an Aeri, there is no way to step through the patterns one at a time. When using a Unifi, the Pattern Sequence Browser can send its current voltage pattern to the mirror. By selecting the pattern you wish to use and sending it to the mirror, you can step through the patterns and view them, one at a time.
- **3. Can I make the pattern file in Excel?** No. The patterns used by Pattern Player are voltage patterns, and not Optical Phase Difference maps.



Appendix 1.

Creating Your Own Patterns

Step 1. Start up Pattern Player and select the mirror and driver you wish to use. See Pattern Player Startup GUI in the Pattern Player Manual for more information on starting Pattern Player.

Pattern Player Exit Pattern Sequence Browser Help Mirror Driver Select Mirror Select Mirror Select Mirror Select Mirror Select Mirror Select Mirror Mirror Mirror	
Exit Pattern Sequence Browser Help Mirror Driver - Select Mirror - Select Driver	X
Mirror Driver - Select Mirror - • Select Driver - * Select Mirror - • Select Driver - * Select Mirror - • Mirror and Driver	
Select Mirror Select Mirror Select Mirror t Mirror and Driver	
Select Mirror Select Mirror And Driver	•
25.36 Linear 500 stress 34 gap 25.37 Linear 25.37 Linear 25.37 Linear 25.41 CC 48MPa 153/um 50-61 CC 70MPa 125/um 10-8 10-7 AST60307-001 Uniti 16-37 AST60307-001 Uniti 16-37 AST60307-001 Uniti 16-37 AST60307-001 Uniti 16-37 AST 25.41 Kaster Stress 25.61 Linear 25.61 Rectangular 30-37 50-37 50-61 Concentric Circle (Surface) ♥	

Step 2. Select Pattern Sequence Browser from the top menu in Pattern Player.

Exit (Pattern Sequence Browser Help Mirror Driver 50-61 Concentric Circle JD4001 Actuator Map File Name = Select Mirror and Driver Pattern File Name = Select Pattern File Brow	Pattern Player		
Mirror Driver 50-61 Concentric Cicle Select Mirror and Driver Actuator Map File Name = Select Mirror and Driver Pattern File Name = Select Pattern File Brow	Exit (Pattern Sequence	Browser Help	
50-61 Concentric Circle	Mirror		Driver
Actuator Map File Name = Select Mirror and Driver Pattern File Name = Select Pattern File Brow	50-61 Concentric Circle	▼ D40D1	
Pattern File Name = Select Pattern File Brow	Actuator Map File N	ame = Select Mirror and	d Driver
	Pattern File Name =	Select Pattern File	Browse

Select Pattern Sequence Browser



3. You will be greeted with a file selection screen. Select 'Cancel', since we don't want to load any files.



4. You will now be greeted with a display that shows your selected mirror on the right. This is the Pattern Sequence Browser. See Pattern Sequence Browser in the Pattern Player manual for more information on how to use the Pattern Sequence Browser.





5. Now we will populate the mirror with voltages. There are many ways to set the voltage on a particular mirror actuator.

a) Left-click on the actuator. This increases the voltage on the selected actuator by the Step value.

b) Right-click on the actuator. This decreases the voltage on the selected actuator by the Step value.

c) Press the middle mouse button while the mouse pointer is on the actuator. This sets the voltage on the selected actuator to 0.

d) Select the actuator by left-clicking on it. Then edit its voltage using either the voltage scroll bar or the voltage scroll bar's edit box.

6. Once you are satisfied with your voltage pattern, set it's name in the "Editable Pattern" edit box and press the "Add Pattern" button to add it to your list of patterns.





7. Now you can alter the actuator voltages again without losing your new pattern. Feel free to add as many new patterns as you'd like.



8. Once you have all the patterns you want, it is time to save the patterns to a file. Select "Save File" from the controls in the upper-left of the Pattern Sequence Browser GUI.





9. Set your file name and press 'Save'. Your file is now saved and ready for use in Pattern Player.



