

# HighFinesse Tutorial

# HighFinesse Digital PID Option: Laser Control

HighFinesse Tutorial · Digital PID option · 9-2024 This document provides general information only and may be subject to change at any time without prior notice.

Overview

## How to ...

# ... set up the HighFinesse Digital PID Option: Laser Control

This option can be used with TOPTICA lasers controlled by a DLC pro only. This quickstart guide is intended to give you a brief overview of how to configure the HighFinesse laser control settings. The guide does not replace reading the manual. Make sure you have read and understood it (especially section 3.5) before you start the regulation. Setting voltage bounds incorrectly might cause damage to your laser.

Here we assume that the laser is already successfully connected with a fiber to the wavelength meter. If you have any questions about that refer to the quickstart guide "HighFinesse Wavelength Meter"

#### **Further information**

Quick Start Guide HighFinesse Wavelength Meter

https://www.highfinesse.com /en /support /quick-start-guide.html



Start the software and set the voltage bounds in the Laser Control Menu such that you can exclude a damage to your laser and make sure the output range is suitable (e.g. as defined by a mode-hope-free scanning range).



2	
6	

#### Laser Control

Regulation signal	active	Port ∢ 1	2345678
Modify	Altering sensitivity	Errorsignals	<u>C</u> alibration
DLC   <u>R</u> e	ference   Regulation & <u>S</u> e	ansitivity <u>B</u> oun	ds   ⊻arious
🖵 Signal bounds [mV	]		
Minimun 0	- Maximun 140000 -		
<ul> <li>Adjust refere</li> </ul>	nce midway (70.000,0 mV)		
C Adjust refere	nce at 70000 - m√		
Behaviour on excee Only cut at s Output errory	eding bounds ignal bounds value [mV]		
at min.  U	i history		
- Maximum shot-p	per-shot change [mV]		
10000 -	💌 allow towards zero		
	T drive immediately		

Click on the black triangle 1a to obtain more settings. Move to the frame bounds to enter the correct bounds.



Connect the DLC pro Controller and the computer running the wavelength meter software to the same network (UDP has to be allowed for automatic recognition).

In restrictive network it might be necessary to specify the IP address and the port of the DLC pro **Controller** (Standard port: 1998) in the **"Adjust ports" menu → "Additional IPs".** 



Laser Control												x
Regulatio	n signal	active	5				F	Port	1	23	45	678⊧
⊻arious ) D <u>L</u> C	<u>M</u> odify <u>R</u> e	y   ferend	<u>A</u> lte ce	ring s	ensiti Reg	vity ulatio	 n & ,	<u>E</u> rrors <u>S</u> ensi	ignal: itivity	s	<u>C</u> al B	ibration
Signal ∢ 1 2	34	5 6	7 C	ŀ						Aut C	o clea Ilear r	ar history Iow
Course: f(	t) [nm] 722	•	,							Ins	sert	-
	<b></b> ;											
											-	
632,99107												
				-							-	
												t [s]
	05	10	15	20	25	30	35	40	45	50	55	60

Choose the port where the digital signal will be put out by **clicking** on the black numbers.



to the port.

Then click on one of the colored numbers to assign the switch signal



You can unassign it by clicking on the same number again. In the example the Switch signal 5 is assigned to port 1.



### Laser Control Port ∢ 1 2 3 4 5 6 7 8 ⊁ Regulation signal active DLC -Reference wavelength [nm] 632,9910722 ▲ ▼ Apply Adjust ports

You can use the "Adjust ports" menu for assigning the lasers to the ports.

#### Decta a sa ta

Port	Switch signal	Lonnected laser	Assigned laser	
Port 1	Signal 5	DL* 633 SN_"020697" @DLC PRO_0	041463 Last effectual	
Port 2	Signal 2		Last effectual	
Port 3	Signal 3	-	Last effectual	
Port 4	Signal 4	-	Last effectual	
Port 5	-	-	Last effectual	
Port 6	Signal 6	•	Last effectual	
Port 7	Signal 7	-	Last effectual	
Port 8	Signal 8	-	Last effectual	
Dort 1	poologood suitels -	ian d		
FUIL I -	assigned switch s	siynal		
Signa	15	- -		Apply
Signa Port 1 - Lase	l 5 assigned laser — er	- -		Apply
Signa Port 1 - Lase Any (I Any none DL* 6	I 5 assigned laser — er <mark>ast effectual prefe</mark> :33 SN_''020697''	erred) @DLC PR0_041463	Connection via ▼ TCP/IP (managed via UDP) ▼ TCP IP	Apply Port
Signa Port 1 - Lase Any (I Any none DL* 6	I 5 assigned laser — er ast effectual prefe :33 SN_''020697''	<pre>srred)</pre> @DLC PR0_041463	Connection via ▼ TCP/IP (managed via UDP) ▼ TCP IP	Apply Port
Signa Port 1 - Lase Any () Any DL* 6	I 5 assigned laser — er ast effectual prefe 33 SN_''020697''	erred) @DLC PR0_041463	Connection via ▼ TCP/IP (managed via UDP) ▼ TCP IP	Port

In this example, the **light** output of the laser is connected to **channel 5** on the switch.

Both channel 5 and the correct laser are assigned to digital Port 1.

### Use the **PIDSim2 Tool** to simulate good starting parameters.

Alternatively, you can set PID parameters manually in the laser control settings/frame: "Regulation & Sensitivity".

Regulation signal active       Port < 1 2 3 4 5 6 7 8 >         Various       Modify       Altering sensitivity       Errorsignals       Calibration         DLC       Beference       Regulation & Sensitivity       Bounds         Regulation       Constant dt       P 0,16       I       0.84       I         ✓ Constant dt       P 0,16       I       0.84       I       I       0.84       I         ✓ Use ta in I and D       I       0.84       I
Various       Modify       Altering sensitivity       Errorsignals       Calibration         DLC       Beference       Regulation & Sensitivity       Bounds         Regulation       ✓       Constant dt       P       0,16       +         ✓       Constant dt       P       0,16       +       +         ✓       Use ta in I and D       I       0,84       +       +         ✓       Use ta in I and D       I       0,034       +       +         Sensitivity       D       0,034       +       +       +         Actual sensitivity:       1 V/pm       Min. resolution:       671 e-21 m       Deviation range:       [-70 pm, 70 pm]         1,00       ✓ /       I       I       I       I       I       I
Regulation         Image: Constant dt of [s] 0.010         Image: dt [s] 0.010         Image: dt [s] 0.020         Image: dt [s]
t <sub>a</sub> [s] 0,020 $\overrightarrow{}$ D 0,034 $\overrightarrow{}$ Sensitivity Actual sensitivity: 1 V/pm Min. resolution: 671 e-21 m Deviation range: [-70 pm, 70 pm]
Actual sensitivity: 1 V/pm Min. resolution: 671 e-21 m Deviation range: [-70 pm, 70 pm] 1,00 V /
μm nm pm tm
Polarity Positive



### Start the PIDSim2 application located in the path ...

Installation Path of the Wavelength Meter Software \Tools \PIDSim2.exe

... and make sure you can measure.

7	7a PIDSim2 Settings
General Measurement count 200 Time / Measurement [s] 0.020 Laser 1 / Amplification 1 1.00 V / pm 0 V Wavelength 632.991075	General Measurement count 200 Time / Measurement [s] 0.020 Response count 2 VOut minimum [V] 0.000
Regulation         f(t) [nm]         632,9910722         I         ta [s]         P         0.040         I         1.00         Auto TPID         D         0.060         Clear history on range exceed         Sensitivity         I         1.00	VOut maximum [V] 140.001 VOut resolution [mV] 0.001 Synchronize f and r Laser 1 / Amplification 1 1.00 V / pm V / pm
Clicking on the <b>small black triangle</b> will enable more settings.	Now you can <b>make your setti</b> for simulation.

•••••

ings for simulation.

Measurement count:

number of points in the simulation.

### Time/Measurement [s]:

get this live from the wavelength meter by clicking on the red dot and confirm by clicking on the checkmark.

### **Response Count:**

set in 1.).

2 for single channel, 1 for multichannel measurements.

### Set the minimum and maximum output according to your system (voltage bounds

Set the **resolution** to obtain a realistic simulation of your system.

8 Show more settings	<b>8</b> a
Regulation	Connecti
= 632,9910722	In which synchron
✓ ta [s]     P     0.25     .       0.040     .     1.00     .	WLM
Auto TPID D 0.060	PIDSi
Sensitivity ➡ 1.00 ➡ V / nm  ■	Choose to <b>s</b> v
Synchronize WLM	PIDSim2 in t
The tool can be used as a <b>pure</b>	Choose <b>PIDS</b>

simulation tool or synchronized to the wavelength meter software running in parallel.

You can alternatively also transfer all settings you have made from the wavelength meter to the PIDsim2 tool.



ynchronize the the section regulation.

Sim --> WLM.



**8**b

After that set the port that you would like to adjust.

#### Amplification settings

Collection points per cycle 900

Upper voltage border [mV] 1250

Lower voltage border [mV] -1250

Click on the blue triangles to enter the bounds (range should be smaller or equal to the bounds in 1.) and number of collection points used for calculation.

Then click on the red dot <sup>9b</sup> to automatically determine the sensitivity. Once this is determined transfer the result to the frame "Regulation" and enter it as the "Sensitivity" of the laser.

**Caution:** this will vary the output voltage, so a safe choice for the bounds is important.

– Lase
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Sudde





#### Reference Voltage

Reference Voltage [mV] 1000

Laser 0

Click on the **blue triangle** 10a.

Enter the **current voltage** 10b.

Get the corresponding wavelenth by clicking on the red dot 100.







Regulation
fítì [nm]
= 632,9910722
✓ ta [s] P 0.25
0.040
Auto TPID D 0.060
Clear history on range exceed
Sensitivity
∓ 1.00 ▲ V/pm ▼
Synchronize WLM

<b>11</b> a
Regulation
= 632,9910722
✓ ta [s] P 0.25
Auto TPID D 0.060
Clear history on range exceed
Sensitivity
Synchronize WLM

Enter a target wavelength or a function.

In this example the laser should be **stabilized at 632.9910722 nm.** 





Press "Auto TPID" to determine the
PID parameters. Finally, you can close
the PIDSim2. Now the system should
be ready for a test.



#### Laser Control

Laser Control													x
Regulation	n signal	active	YAK				F	ort 🔹	1 2	2 3	45	678	Þ
<u>V</u> arious	<u>M</u> odify		<u>A</u> lte	ring s	ensiti	vity	l <u>I</u>	Errors	ignals	:	<u>C</u> a	libration	
DLC	<u>R</u> e	ferenc	e:		Reg	ulatio	n & <u>}</u>	<u>S</u> ensi	itivity		<u>B</u>	ounds	
Signal < 1 2	3 4	5 6	7 C	F						Aut	o cle	ar history	
– Beference –										C	lear r	now	1
Course: fi	t) [nm]	+								Ins	ert	Ŧ	
= 632,9910	1722												
,													
												4 1	
				1									
632,99107		   		1		 	1	1	-	-	1		
	1					 							
												t [s]	
	0 5	10	15	20	25	30	35	40	45	50	55	60	
													1

For this start the Regulation.

You can **optimize the regulation** further by using the LongTerm application and minimizing possible unwanted effects by altering the PID parameters.





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