DIGITAL LASER DRIVER WITH RS-232 OR USB INTERFACE

FLEXPOINT® Laser Modules

DIGITAL LASER DRIVER ENABLES COMMUNICATION WITH THE LASER MODULE AND A MORE REPRODUCIBLE MODULATION BEHAVIOUR

LASER COMPONENTS offers a digital laser driver with a microcontroller to enable digital communication, so that the laser module can be monitored and controlled. The digital driver makes it possible to interface with the laser module using RS-232 or USB. Even major operational settings such as output power and dimming, pulsing, and modulation can be programmed by the customer.

FEATURES

/ Interface with laser module via USB or RS-232
/ Monitoring of the laser module (temperature inside the module, present laser power, etc.)
/ Microcontroller ensures outstanding output power stability
/ Reproducible linearity for dimming (real linear behaviour between output power and control voltage)

APPLICATIONS

/ Receive feedback from the status of the laser module
/ Receive parameters for predictive maintenance
/ Reproducible and linear behaviour for dimming of a laser module
/ Defined behaviour for digital modulation of the laser module

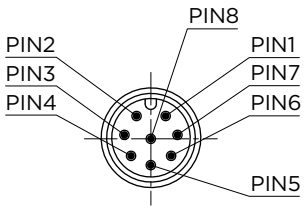
03/25 / V02 / KS-MaL / manuals/laser-modules/flexpoint-digital-laser-driver

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

SPECIFICATIONS
RS-232 INTERFACE

Connection of Digital Lasers: The standard interface is an 8-pole cable.

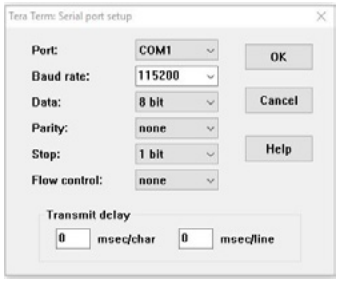
PIN #	Description	Explanation (including maximum rating)	Cable color
1	V_{IN}	Operating voltage: 4.5 V (–10 %) ≤ V_{IN} ≤ 30 V (+10 %)	Red
2	V_{Dim}	Dimming voltage: 0 V (–0.5 V) ≤ V_{Dim} ≤ 5 V (+0.5 V)	White
3	$V_{Modulation}$	Modulation input (trigger): $V_{Modulation}$ follows TTL logic 1 (high) ≙ +2 V to +5.3 V 0 (low) ≙ –0.3 V to 0.8 V	Green
4	RxD	RS-232	Yellow
5	TxD	RS-232	Orange
6	C2CK	Internal use only	Blue
7	C2D	Internal use only	Brown
8	GND	Ground	Black



Setting of the Serial Interface in the Terminal Program

A driver does not have to be installed for the RS-232 interface.

Setting up serial port	
Port	COM
Baud rate	115200
Data	8 bit
Parity	none
Stop	1 bit
Flow Control	none

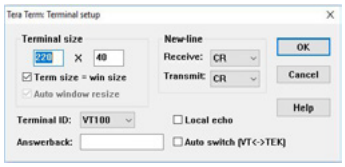


Example of Tera Term (left) and HTerm (above)

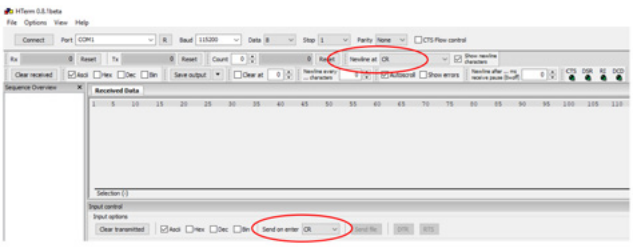
Settings for Receiving and Sending Data

Setting for CR transmission

Terminal Setup	
Receive	CR
Transmit	CR



Example of Tera Term (above) and HTerm (right)



After successful initialization of the serial interface, the module is started by applying the operating voltage V_{IN} and then signals via the COM port as follows:

```
(C) 2018 Laser Components GmbH
Digital-Laser-Driver 2v1
```


/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

RS-232 Commands

<table>
<tr><th>Command</th><th>Parameter</th><th>Description</th></tr>
<tr><td>trig</td><td>x</td><td>Digital modulation
This command determines at which modulation voltage the laser is active.
<table><tr><th>x</th><th>Mode</th></tr><tr><td>1</td><td>Low Active</td></tr><tr><td>2</td><td>High Active</td></tr></table>It is important that:
1. The modulation input be set to GND via a pull-down resistor so that when the modulation voltage is not connected, the input is »low«. This results in the laser being active at the »low active« setting and inactive at the »high active« setting.
2. This setting affects the operation of the digital modulation with an internal trigger source (see »duty« command).
Chapter 2.6 describes digital modulation with external triggers in more detail.</td></tr>
<tr><td rowspan="2">dima</td><td rowspan="2">x y z</td><td>Analog Dimming
This command defines the voltage range for dimming with an external analog voltage V_{Dim}. The parameters x and y define the upper and lower voltage of the control range. The values of the parameters must be given in 1/10 V, which results, for example, in 10 ≙ 1.0 V. The following applies to x and y:
$x,y \in \mathbb{Z}, \{x,y \mid [0, 50]\}$
The parameter z for setting the active range. The following applies:
<table><tr><th>z</th><th>Mode</th></tr><tr><td>1</td><td>Low Active</td></tr><tr><td>2</td><td>High Active</td></tr></table></td></tr>
<tr><td>Example »dima 50 0 1«
The laser is dimmable with an external voltage (V_{Dim}) in the range of 0.0 V to 5.0 V. Dimming is »low active«, i.e. at $V_{Dim} \geq 5.0$ V the laser is off, and at $U_{Dim} \leq 0.0$ V the laser lights up with maximum power. In the range of $5.0\,V > U_{Dim} > 0.0$ V, the power is dimmed linearly (see also chapter 2.7).</td></tr>
<tr><td rowspan="2">dimp</td><td rowspan="2">x</td><td>Digital Dimming
The output power of the laser is calculated according to:
$$P_{Opt} = P_{Opt\_max} \cdot \left(\frac{x}{1000}\right)$$
$x \in \mathbb{Z}, \{x \mid [0, 1000]\}$
Dimming is carried out by reducing the current flowing through the laser diode. This is not a reduction of the laser power with the help of pulse width modulation (PWM). The value that results from digital dimming is stored on the EEPROM.</td></tr>
<tr><td>Example: »dimp 500« results in an optical output power which is half the maximum possible laser power (see also chapters 2.8 and 1).</td></tr>
</table>

RS-232 Commands

<table>
<tr><th>Command</th><th>Parameter</th><th>Description</th></tr>
<tr><td rowspan="2">duty</td><td rowspan="2">x y</td><td>Digital modulation with internal trigger
With the »duty« command, the duty cycle for autonomous pulses and the trigger frequency can be defined. This special form of digital modulation is referred to as PWM.
The duty cycle is determined by the parameter x.
$x \in \mathbb{Z}, \{x \mid [0, 100]\}$
The frequency can be set by parameter y as follows:
<table>
<tr><th>y</th><th>Frequency [kHz]</th></tr>
<tr><td>1</td><td>382.8</td></tr>
<tr><td>2</td><td>95.7</td></tr>
<tr><td>4</td><td>31.9</td></tr>
</table>
With the command »duty 0« the internal trigger function is deactivated.</td></tr>
<tr><td>Example: The command »duty 50 1« generates a duty cycle of 50 % at a frequency of 382.8 kHz. (See also chapter 1.6.)
$t_{ON} = t_{OFF} = 1.3\,\mu s$</td></tr>
<tr><td>powL</td><td>–</td><td>Displays present laser power [mW]</td></tr>
<tr><td>mon1</td><td>–</td><td>Reflects present laser status using the following parameters:
- Supply voltage V_B [V]
- Internal voltage V_{CC} [V]
- Monitor current [µA]
- Laser diode current [mA]
Displays values continuously and can be terminated by pressing the »Esc« button.</td></tr>
<tr><td>temp</td><td>–</td><td>Displays present temperature in the laser module on the electronics (temperature sensor on circuit) [°C]</td></tr>
<tr><td>IDLa</td><td>–</td><td>Displays serial number and part number of the laser module</td></tr>
</table>

Digital Modulation with External Trigger

The »trig x« command is used to set the operating mode of the digital modulation.
There are two operating modes:

x	Mode
1	Low Active
2	High Active

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

Definition of the state of the laser (TTL logic)

$V_{Modulation}$ [V]	State	Laser	
		Low active	High active
–0.3 to +0.8	Low	on	off
2.0 to 5.3	High	off	on

For voltages of 0.8 V < $V_{Modulation}$ < 2.0 V, the state of the laser is not defined.
The frequency and duty cycle are determined by the external modulation voltage $V_{Modulation}$.

In order to obtain reasonable pulses, the following values should be taken into account:

/ Maximum frequency f_{Max} = 1 MHz
/ Minimum pulse width t_{ON_min} = 200 ns

Analog Dimming with External Dimming Voltage

The command »dima x y z« defines the analog dimming function. The parameters x and y define the upper and lower voltage limits within which the output power of the laser is changed linearly. The parameter z defines the treshold value at which the laser either no longer emits or emits at full power.

Example 1: Analog dimming »active low« dima 50 0 1

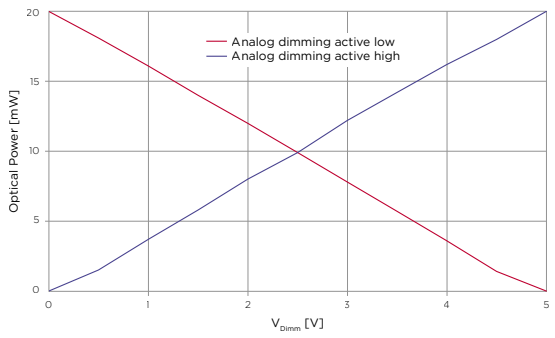
/ »dima« stands for »analog dimming«
/ »50« stands for the upper voltage limit 50/10 V = 5.0 V at which the laser should be off
/ »0« stands for the lower voltage limit 0/10 V = 0.0 V at which the laser is at full power
/ »1« stands for dimming mode; »1« ≙ »low active«

V_{Dim} [V]	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_{Opt} [mW]	20.0	18.1	16.1	14	12	9.9	7.8	5.7	3.6	1.4	0.0

Example 2: Analog dimming »active high« dima 50 0 2

/ »dima« stands for »analog dimming«
/ »50« stands for the upper voltage limit 50/10 V = 5.0 V at which the laser is at full power
/ »0« stands for the lower voltage limit 0/10 V = 0.0 V at which the laser should be off
/ »2« stands for dimming mode; »2« ≙ »high active«

V_{Dim} [V]	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_{Opt} [mW]	0.0	1.5	3.7	5.8	8.0	9.9	12.2	14.2	16.2	18.0	20.0



/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864-0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821-7040 info@laser-components.com www.laser-components.com

Example 3: Analog dimming »active low« dima 40 20 1

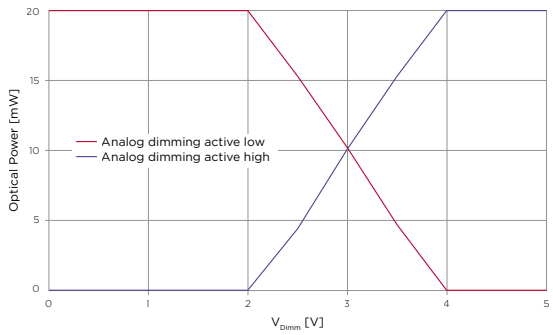
/ »dima« stands for »analog dimming«
/ »40« stands for the upper voltage limit 40/10 V = 4.0 V at which the laser should be off
/ »20« stands for the lower voltage limit 20/10 V = 2.0 V at which the laser is at full power
/ »1« stands for dimming mode; »1« ≙ »low active«

V_{Dim} [V]	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_{Opt} [mW]	20.0	20.0	20.0	20.0	20.0	15.3	10.2	4.7	0.0	0.0	0.0

Example 4: Analog dimming »active low« dima 40 20 2

/ »dima« stands for »analog dimming«
/ »40« stands for the upper voltage limit 40/10 V = 4.0 V at which the laser is at full power
/ »20« stands for the lower voltage limit 20/10 V = 2.0 V at which the laser should be off
/ »2« stands for dimming mode; »2« ≙ »high active«

V_{Dim} [V]	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_{Opt} [mW]	0.0	0.0	0.0	0.0	0.0	4.4	10.1	15.3	20.0	20.0	20.0



Digital Dimming

Digital dimming via the command »dimp x« works in the same way as a laser with a USB interface. Therefore, please refer to chapter 2.5

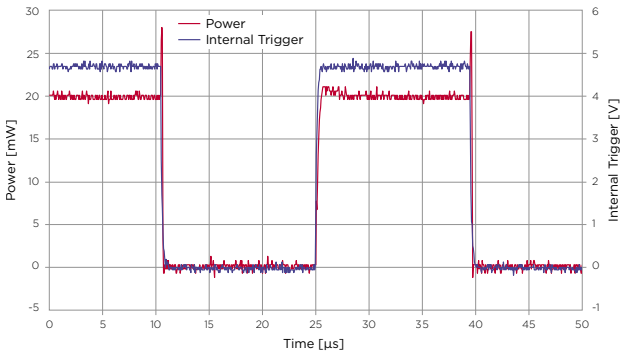
Digitale Modulation with an Internal Trigger Source

Digital modulation with an internal trigger source via the command »duty x y« corresponds to the digital modulation of a laser with a USB interface. Therefore, please refer to chapter 2.6 for detailed information on operation and setting options.

In addition, the $V_{Modulation}$ connection on the laser with an RS-232 interface allows the internal trigger signal to be tapped for synchronization purposes.

Important: The trigger voltage should be tapped via a high-impedance termination (e.g., 1MΩ). When terminated with 1 MΩ, the amplitude of the trigger signal is approximately 4.7 V.

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com



Digital modulation »duty 50 2«: f = 95.7 kHz; duty = 50 %; tDelay = 20 ns

Combination Options

The possibilities of combining modulation with dimming are shown below:

Modulation with	Dimming
External source	analog (dima)
	digital (dimp)
Internal trigger source (duty)	analog (dima)
	digital (dimp)

Analog dimming (»high active«)

Important: Only one type of modulation and only one type of dimming can be active at any one time.

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

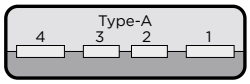
SPECIFICATIONS
USB INTERFACE

Description of the Interface

In contrast to a laser with an RS-232 interface, a laser with a USB interface has only one USB type A connector with four pins.

PIN	Signal	Description
1	V_{BUS}	+5 V supply voltage
2	D-	Data USB 2.0, differential pair -/+
3	D+	
4	GND	Mass

PIN assignment of USB 2.0 type A connector



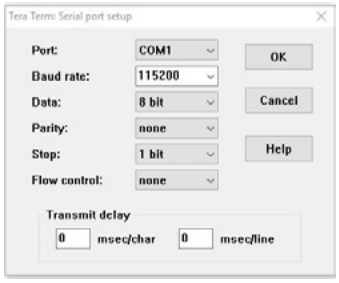
The driver for the USB interface is automatically searched for by the operating system and then installed. This happens as soon as the module is connected to the USB interface of the computer or a hub connected to the computer. If this is not the case, the driver can be downloaded under the following link and installed manually:

Driver software: https://ftdichip.com/drivers/d2xx-drivers/

After successful installation, a new COM port is listed in the device manager. Communication with the laser can take place via this serial interface.

Setting up the Interface in the Terminal Program:

Serial port settings	
Port	COM
Baud rate	115200
Data	8 bit
Parity	none
Stop	1 bit
Flow Control	none

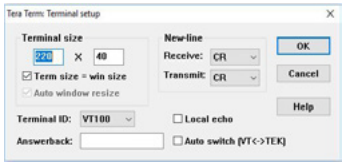


Example of Tera Term (left) and HTerm (above)

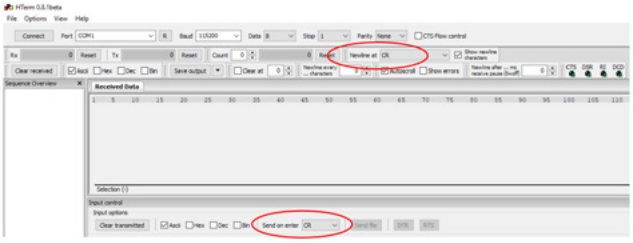
Settings for Receiving and Sending Data

Setting for CR transmission

Terminal Setup	
Receive	CR
Transmit	CR



Example of Tera Term (above) and HTerm (right)



USB Commands

Command	Parameter	Description
dimp	x	Digital Dimming The output power of the laser is calculated according to: $P_{Opt} = P_{Opt\_max} \cdot \left(\frac{x}{1000}\right)$ $x \in \mathbb{Z}, \{x \mid [0, 1000]\}$ Dimming is carried out by reducing the current flowing through the laser diode. This is **not** a reduction of the laser power with the help of pulse width modulation (PWM). The value that results from digital dimming is stored on the EEPROM.
		Example: »dimp 500« results in an optical output power which is half the maximum possible laser power (see also chapters 1.5).
duty	x y	Autonomous Pulses With the »duty« command, the duty cycle for autonomous pulses and the trigger frequency can be defined. This special form of digital modulation is referred to as PWM. The duty cycle is determined by the parameter x. $x \in \mathbb{Z}, \{x \mid [0, 100]\}$ The frequency can be set by parameter y as follows: y: 1 → 382.8 kHz; 2 → 95.7 kHz; 4 → 31.9 kHz With the command »duty 0« the internal trigger function is deactivated.
		Example: The command »duty 50 1« generates a duty cycle of 50 % at a frequency of 382.8 kHz. (See also chapter 2.6.) $t_{ON} = t_{OFF} = 1.3\,\mu s$
powL	–	Displays present laser power [mW]
mon1	–	Reflects present laser status using the following parameters: - Supply voltage V_B [V] - Internal voltage V_{CC} [V] - Monitor current [µA] - Laser diode current [mA] Displays values continuously and can be terminated by pressing the »Esc« button.
temp	–	Displays present temperature in the laser module on the electronics (temperature sensor on circuit) [°C]
IDLa	–	Displays serial number and part number of the laser module

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

Digital Dimming

The laser power of the laser module can be adjusted with the help of the command »dimp x«. PWM is not used for this purpose. Rather, the power is regulated by the current of the laser diode.

The output power of the laser is calculated according to:

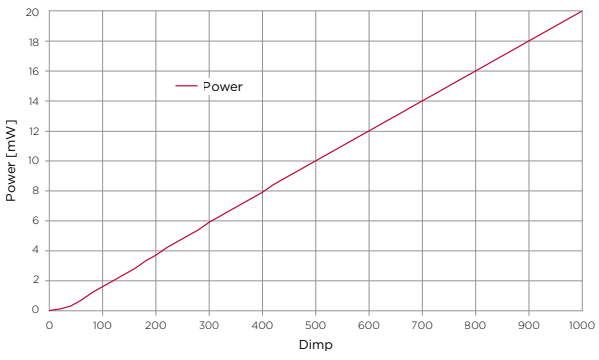
$$P_{Opt} = P_{Opt\_max} \cdot \left(\frac{x}{1000}\right)$$

Example: A laser with P_{Opt_max} = 20 mW receives the command »dimp 500«, which results in the reduced output power P_{Opt} as follows:

$$P_{Opt} = P_{Opt\_max} \cdot \left(\frac{x}{1000}\right) = 20\,mW \cdot \left(\frac{500}{1000}\right) = 10\,mW$$

For a laser with P_{Opt_max} = 20 mW, the measured power was assigned to each control command »dimp x« (see Table 17) and then the course of the power over x graphically displayed (see Figure 14).

x	0	20	40	60	80	100	120	140	160	180
P_{Opt} [mW]	0.0	0.1	0.3	0.7	1.2	1.6	2.0	2.4	2.8	3.3
x	200	220	240	260	280	300	320	340	360	380
P_{Opt} [mW]	3.7	4.2	4.6	5.0	5.4	5.9	6.3	6.7	7.1	7.5
x	400	420	440	460	480	500	520	540	560	580
P_{Opt} [mW]	7.9	8.4	8.8	9.2	9.6	10.0	10.4	10.8	11.2	11.6
x	600	620	640	660	680	700	720	740	760	780
P_{Opt} [mW]	12.0	12.4	12.8	13.2	13.6	14.0	14.4	14.8	15.2	15.6
x	800	820	840	860	880	900	920	940	960	980	1000
P_{Opt} [mW]	16.0	16.4	16.8	17.2	17.6	18.0	18.4	18.8	19.2	19.6	20.0



Linearity of digital dimming

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

Digital Modulation

The digital modulation of the USB laser is a PWM with its own trigger source.

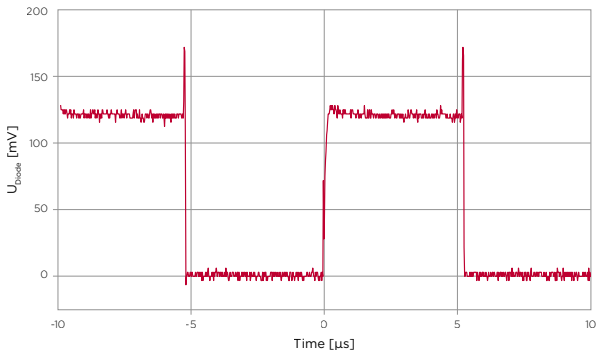
The command »duty x y« defines both the duty cycle and the frequency. The parameter x stands for the value of the duty cycle [%], and the parameter y stands for the frequency. There are three frequencies that can be selected with y.

y	Frequency [kHz]
1	382.8
2	95.7
4	31.9

Frequencies of the internal trigger source

Example: duty 50 2

The duty cycle is set to 50 % and the trigger frequency to 95.7 kHz. A fast PIN diode displays the emitted laser power as voltage on an scilloscope (see Figure 15).



Duty cycle: 50 % at f = 95.7 kHz

Important: The command »duty 0« deactivates the digital modulation with an internal trigger source. This is also the switchon state of the laser. This means that if the supply voltage is interrupted and reapplied, the digital modulation with an internal trigger source is deactivated.

Combination of Digital Dimming and Modulation

The two power setting options (1.6 and 1.7) can also be combined. With the command »dimp«. the pulse power of the PWM can be adjusted. Thus, not only can the duty cycle and frequency be variably adjusted but the pulse power as well.

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

EXAMPLE FOR OPERATION OF THE LASER VIA USB

Retrieval of information on the current state of the laser via »mon1«:

```
>mon1
```

Input is confirmed via »Enter«. The response is continuous output as in the following:

```
Supply Voltage: 11.934V, Internal Voltage: 7.91V, Monitor Current: 0 uA, Laser Current: 184 mA
```

With »Esc«, the output is interrupted, and further commands can be entered.
For example, the type of modulation can be changed from »low active« to »high active« with the command »trig 2«.

```
Supply Voltage: 11.934V, Internal Voltage: 7.91V, Monitor Current: 0 uA, Laser Current: 184 mA
trig2
```

Input is confirmed again via »Enter«. The following response is produced:

```
Supply Voltage: 11.934V, Internal Voltage: 7.91V, Monitor Current: 0 uA, Laser Current: 184 mA
Trigger high aktiv!
```

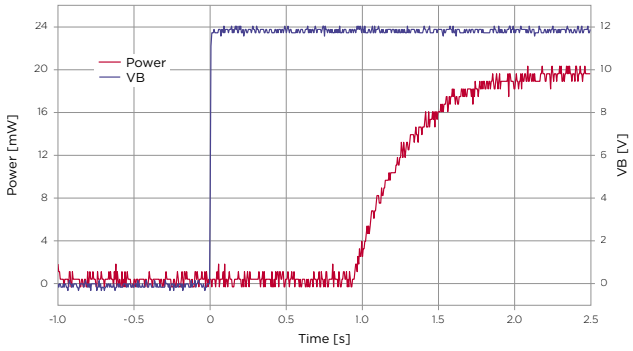

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 - 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 - 7040 info@laser-components.com www.laser-components.com

BEHAVIOR OF THE LASER WHEN SWITCHING THE SUPPLY VOLTAGE VB ON AND OFF

The switch-on and switch-off behavior was investigated using a laser with a wavelength of λ = 520 nm and an optical output power of P_{OUT} = 20 mW.

Switch-on Behavior

The laser requires a certain amount of time to connect to the supply voltage until the laser emits the desired power. For VB = +12 V, this is shown in Figure 16:



Switch-on behavior at +12 V

The first 900 ms (t_{Start}) require the firmware and electronics to be ready for operation. The laser power is then set. In contrast to digital modulation, further capacitances are charged, which results in a relatively long rise time of 530 ms.

In total, there is a delay time of t_{Delay} = 1.175 s. Delay, in this case, refers to the timespan between 50 % VB and 50 % laser power.

Further investigations with other voltage values for VB show that both t_{start} and t_{delay} are constant and thus independent of VB. Only the rise time of VB can influence t_{delay} in this case.

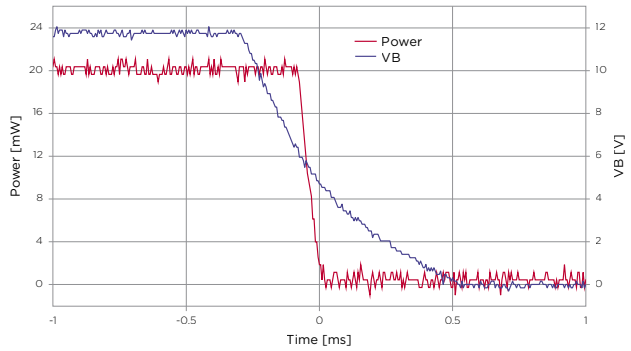
/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

Switch-off Behavior

It is crucial to differentiate between two situations regarding the switch-off behavior.

Switching from VB to GND

When switching the voltage from VB to GND, the following behavior is exhibited (see Figure 17).
The switch-off time depends on the original value of the voltage VB; however, this correlation is not linear.



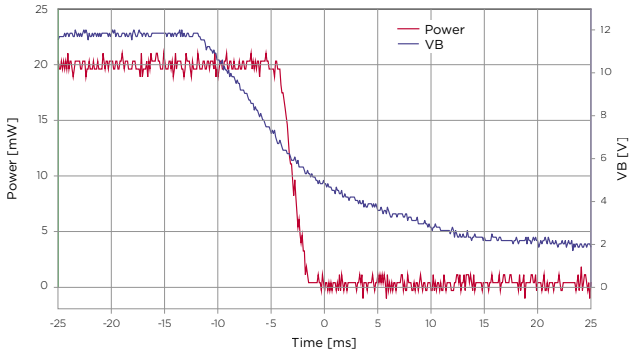
Time from the beginning of switching VB to achieving the »laser is off« state (switch-off time)

VB	Switch-off time
+12 V	310 µs
+20 V	590 µs
+30 V	590 µs

Laser switch-off time when VB goes to 0 V

Interruption of VB

If the supply voltage is interrupted, the switch-off behavior changes. Since the large capacitances of the input filter can no longer be discharged via VB = 0 V, the laser emits an afterglow (see Figure 18).
The switch-off time in this case also depends on the original value of the voltage VB.



Switch-off time in case of interruption of VB = +12 V

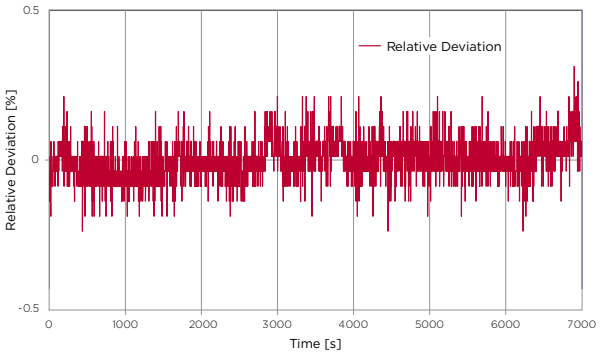
VB	Switch-off time
+9 V	5.8 ms
+12 V	10.4 ms
+15 V	15.4 ms
+24 V	33.6 ms
+30 V	46.0 ms

Laser switch-off time when VB is interrupted

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 – 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 – 7040 info@laser-components.com www.laser-components.com

POWER STABILITY AT CONSTANT AMBIENT TEMPERATURE

The power stability of the digital laser at room temperature (ϑ = +25 ±3 °C) is better than a deviation of ±0.5% (see Figure 19).



Stability at ϑ = 25 °C

Target value	Average value $P_{Opt\_Average}$	Minimum of e_{rel}	Maximum of e_{rel}
20 mW	19.9675 mW	- 0.24 %	+ 0.31 %

Data on stability

HOUSING DIMENSIONS

To order a FLEXPOINT® laser module with a digital laser driver please add »DIG« to the ordering code as follows:

FP-MVmicro-**DIG**-660-10-30-F-RS232; FP-MVmicro-**DIG**-660-10-30-F-USB

When using the digital laser driver, the housing dimensions of the different FLEXPOINT® laser module series may change to the values listed in the table below.

Laser Module Model	Communication Interface	Housing diameter [mm]	Housing length [mm]
FP-D / FP-DOE	RS-232	11.5	67
	USB		
	RS-232	19	77
	USB		68
FP-L	RS-232	11.5	67
	USB		
	RS-232	19	86
	USB		77
FP-MVmicro	RS-232	19	98.6
	USB		
FP-HD	RS-232	19	98.6
	USB		
ILM12F / ILM12IP	RS-232	M12	68
	USB		
FP-MVstereo	RS-232	19	98.6
	USB		

/ Germany and Other Countries LASER COMPONENTS Germany GmbH Tel +49 8142 2864 - 0 info@lasercomponents.com www.lasercomponents.com
/ France LASER COMPONENTS S.A.S. Tel +33 1 39 59 52 25 info@lasercomponents.fr www.lasercomponents.fr
/ United Kingdom LASER COMPONENTS (UK) Ltd. Tel +44 1245 491 499 info@lasercomponents.co.uk www.lasercomponents.co.uk
/ Nordic Countries LASER COMPONENTS Nordic AB Tel +46 31 703 71 73 info@lasercomponents.se www.lasercomponents.se
/ USA LASER COMPONENTS USA, Inc. Tel +1 603 821 - 7040 info@laser-components.com www.laser-components.com