

LDD100-Fxxx

LDD100-Lxxx

LDD100-XLxxx

**Laser Diode
Driver**

Read this instruction manual before performing any task!

Original Operating Instructions

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1 About this manual

1.1 Information about this manual

This manual is valid for units with firmware version FW3.0.

This manual enables you to handle the device in a safe and efficient manner. This manual is part of the device and must be kept in its vicinity in order to ensure that it is available to the personnel at all times.

The personnel must have carefully read and understood this manual before commencing any work. The compliance with all safety information and instructions provided in this manual is essential for safe operation.

Furthermore, all local work protection and general safety regulations applicable at the device's place of installation must be observed.

The illustrations used throughout this manual are intended to provide a general understanding and may deviate from the actual model of the machine.

1.2 Explanation of symbols

Safety instructions

Safety instructions are marked with symbols in these instructions. The safety instructions are always introduced by signal words which express the extent of the danger.



DANGER!

This combination of symbol and signal word indicates an immediately-dangerous situation which could cause death or severe injuries if not avoided.



WARNING!

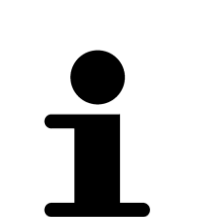
This combination of symbol and signal word indicates a possibly-dangerous situation which could cause death or severe injuries if it is not avoided.

**CAUTION!**

This combination of symbol and signal word indicates a possibly-dangerous situation which could cause slight injuries if it is not avoided.

**NOTICE!**

This combination of symbol and signal word indicates a possibly-dangerous situation which could cause property and environmental damage if it is not avoided.

**Tips and recommendations**

This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:

**DANGER!**

This combination of symbol and signal word indicates an immediately-dangerous situation due to electric shock. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

**DANGER!**

This combination of symbol and signal word indicates an immediately-dangerous situation due to laser emission. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

1.3 Copyright

The contents of these instructions are copyrighted. Their use is permitted in the context of using the device. Any use extending beyond this is not allowed without written permission from the manufacturer.

1.4 Customer service

Our customer service is available for technical information and service:

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We are also always interested in information and experiences gathered from use which could be valuable for the improvement of our products.

2 Safety

This section provides an overview of all safety aspects that are essential to the best possible protection of the personnel and the safe and trouble-free operation of the machine. Additional safety instructions for specific work tasks are contained in the sections regarding the individual life stages of the machine.

2.1 Intended use

The laser diode driver LDD100 is designed exclusively as a current driver for laser diodes and high power LEDs.

The intended use also includes adherence to all specifications in this manual.

Any use exceeding or differing from the intended use applies as misuse.

2.2 Basic dangers

The following section describes remaining risks which can arise from the device even with proper use.

In order to reduce risks of personal injury and property damage and avoid dangerous situations, the safety instructions listed here and the safety instructions in the other sections of these instructions must be followed.

Electrical current



DANGER!

Life-threatening danger from electrical current!

When touching live parts there is an immediate, life-threatening danger from electric shock. Damage to the housing as well as the cable can be life-threatening!

- Work on the electrical system in the interior of the unit may only be performed by the manufacturer.
- In the event of damage to the housing or the cable, immediately disconnect the voltage supply by pulling out the mains plug and initiate the repair process.
- When making high current connections, please observe the correct order of mounting in order to avoid undue heating of the connection. Mount the cable lug directly onto the contact and then secure with a washer, a lock washer and a nut in that order.

2.3 Responsibility of the owner

Owner:

The owner is any such person who operates the laser diode driver for commercial or economic purpose either by itself or transfers it to a third party for use and bears the legal responsibility for the safety of the user, the personnel or third parties during the operation.

Owner's duties:

The laser diode driver is used in commercial applications. Therefore, the owner of the respective laser diode driver is subject to the statutory duties of work safety.

In addition to the safety instructions in this manual, the safety, work safety and environmental safety regulations applicable for the area in which the electronic ballast is used must be adhered to. In the process, the following applies in particular:

- The owner must remain updated on the applicable work safety regulations and determine, in the scope of a risk assessment, additional dangers which can arise due to the special working conditions at the place in which the electronic ballast is used. This must be implemented in the form of working instructions for the operation of the laser diode driver.
- During the entire period of use of the laser diode driver, the owner must check whether the working instructions meet the current status of the rules and regulations and to adapt them as necessary.
- The owner must clearly regulate and define responsibilities for the operation, fault rectification and cleaning.
- The owner must make sure that all persons who work with the laser diode driver have read and understood this manual. Moreover, the owner must train the personnel in regular intervals and inform them of the dangers.
- The owner must adhere to all statutory provisions in regard to the regular testing of electrical equipment and document this testing.
-

In addition, the owner is responsible for ensuring that the unit is always in a technically faultless condition.

2.4 Personnel requirements

Qualifications:

The various tasks described in this manual place different requirements on the qualification of the persons to whom these tasks are entrusted.



NOTICE!

Insufficiently qualified personnel can cause property damage!

Insufficiently qualified personnel cannot assess the risks when working with the unit.

- All work may only be performed by personnel who are qualified for this purpose.
- Keep insufficiently qualified personnel away from the work area.

Only persons who can be expected to reliably perform this work are permitted to carry out any work with this equipment. Persons whose ability to react is impaired by drugs, alcohol, medications, etc. are not permitted to work with this equipment.

In this manual the following qualifications listed for the personnel for the various tasks are specified:

User:

The user uses and operates the device for its intended purpose without other prior knowledge.

2.5 Symbols on the unit

The following symbols and instruction signs are affixed in the work area. These symbols and instruction signs refer to the immediate vicinity in which they are affixed.

WARNING!

Danger due to illegible signage!



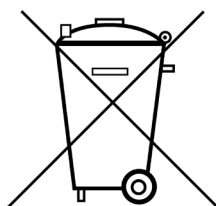
- Over time, stickers and signs can get dirty or in some other manner become illegible, so that dangers cannot be recognized and necessary operating instructions cannot be followed. Thus an injury hazard occurs.
- Keep all safety, warning, and operating instructions that are affixed to the device in legible condition.
- Replace damaged signs or stickers immediately.

Observe the operating manual



Do not use the indicated appliance until the operating manual has been read.

Do not dispose of with the household waste



Notice that the laser diode driver may not be disposed of with the household waste. The worn out unit can be taken to an electronics and metal recycling service for disposal. The manufacturer also accepts old units for disposal.

2.6 Scope of delivery

Depending of the chosen model, the scope of delivery will vary:

- LDD100 laser diode driver controller
- Current end stage unit
- Communication and power cables for the end stage unit
- Mains power supply cable
- USB cable
- USB-Stick with software, drivers and manual

2.7 Transport inspection

On receipt, immediately inspect the delivery for completeness and transport damage.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Issue a complaint in respect of each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

2.8 Packaging

About the packaging

The individual laser diode driver is packaged according to the expected transport conditions. Only environmentally friendly materials were used for the packaging.

The packaging should protect the individual laser diode driver from transport damage, corrosion and other types of damage. Therefore, do not destroy the packaging and save it for later transport and for storage.

Handling packaging materials

If the laser diode driver no longer has to be transported, dispose of the packaging materials in accordance with the respective statutory provisions and local regulations.



NOTICE!

Danger for the environment from improper disposal!

Packaging materials are valuable raw materials and can be reused in many cases or prepared and recycled. Dangers for the environment can arise through improper disposal of packaging material.

- Only dispose of packaging materials once it has been determined that the electronic ballast will no longer be transported.
- Dispose of packaging materials in an environmentally friendly manner.
- Observe the locally applicable disposal regulations. If necessary, commission a specialist company with the disposal.

2.9 Transporting



NOTICE!

Property damage from improper transport!

Improper transport can damage the laser diode driver.

- Always transport the laser diode driver in the packaging provided for this purpose.
- Always proceed with caution with the transport of the laser diode driver in the packaging.
- Do not throw the laser diode driver.
- Protect the laser diode driver from vibrations and moisture.
- Do not let the laser diode driver fall.

2.10 Storage

Store the electronic ballasts in the packaging under the following conditions:

- Do not store outdoors.
- Store in a dry and dust-free area.
- Do not expose to any aggressive media.
- Protect from sun radiation.
- Avoid mechanical vibrations.
- Storage temperature: 15 to 35 °C.
- Relative air humidity: max. 60 %.



Under certain circumstances there are instructions for the storage on the packaging, which exceed the requirements specified here. Follow these accordingly.

3 Product Overview

The LDD100 is a fast, true current source designed for driving laser diodes and high power LEDs. The LDD100 laser diode driver employs a digitally controlled analogue current source to provide for simple, flexible and accurate laser pulsing.

These laser drivers are particularly useful for laser diode testing procedures such as burn-in and LIV measurement. The LDD100 provides up to 120A in pulses ranging from 50ns to 3s duration. The rise time of the pulses is under 50ns with essentially no overshoot.

The flexibility in setup and control makes the unit very useful for general laboratory environments, where high power, pulsed diode lasers are used.

The unit may be USB-controlled for automated measurements. Alternatively, the user may set up all parameters and operate the unit via the front panel keypad and LCD display.

3.1 System Overview

An overview of a typical complete system is depicted in the figure below.



Figure 1: System Overview

The device under test is to be suitably mounted. The low inductance, strip line contact cards available as accessories provides for high current contacts to drive the laser. Various types of cards are available: needle cards for single, bare emitters, strip lines for bare bars, socket cards for packaged lasers such as TO cans and flat packs.

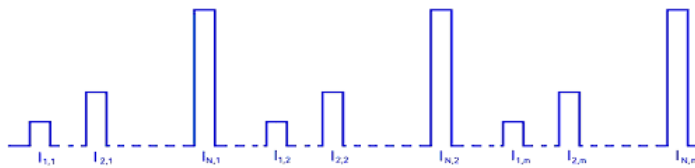
The LDD100 provides sequences of software programmable currents to the laser. Details on these sequences are given in section 3.2 “Modes of Driving” page 20.

3.2 Modes of Driving

The LDD100 supports a variety of modes to allow testing under a wide range of operating conditions. The essential variables available are the output current, pulse width and the pulse separation (or period or frequency). The various modes of operation are described in detail in the subsections below.

3.2.1 Serial Current Sweep

This mode performs a current sweep by stepping the pulse current from the minimum set value to the maximum set value in a number of equidistant currents as determined by the parameter “Steps”. More than one cycle may be run automatically via the parameter “Number of Cycles”. Each sweep is run from the minimum to the maximum current before the next cycle begins. Schematically this appears as follows:



During a sequence, the programmed currents are sequentially set via the controller interface of the LDD100.



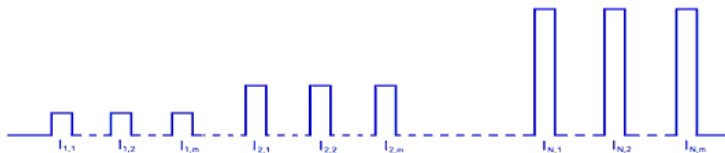
NOTICE!

Note that the current strength selected is critical!

The maximum current of the sweep may be large enough to damage or destroy the laser.

3.2.2 Parallel Current Sweep

This mode performs a current sweep by stepping the pulse current from the minimum set value to the maximum set value in a number of equidistant currents as determined by the parameter “Steps”. More than one cycle may be run automatically via the parameter “Number of Cycles”. Each current of the sweep is pulsed “Number of Cycles” times before the next current is set. Schematically this appears as follows:



During a sequence, the programmed currents are sequentially set via the controller interface of the LDD100.



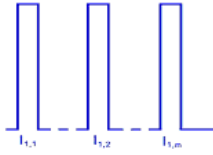
NOTICE!

Note that the current strength selected is critical!

The maximum current of the sweep may be large enough to damage or destroy the laser.

3.2.3 Pulse Mode

The pulse mode is used to pulse the driver at constant current with a single pulse width and pulse separation during the whole sequence.



During a sequence, the programmed currents are sequentially set via the controller interface of the LDD100.



NOTICE!

Note that the current strength selected is critical!

The maximum current of the sweep may be large enough to damage or destroy the laser.

4 Ordering Information

Table 1: Ordering Information F-Version

Full order code: LDD 100-F			c
	Options	Description	
Maximum current (c):	040	40A	←
	120	120A	

4.1 Typical Current Pulse Forms, F-Version

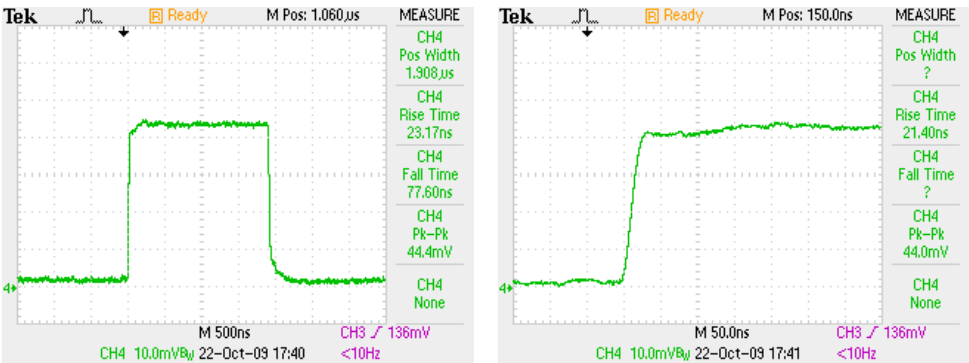


Figure 2: LDD100-F040; 2µs, 40A pulse shape

Table 2: Ordering Information L-Version

Full order code: LDD 100-L			c
	Options	Description	
Maximum current (c):	040	40A	←
	120	120A	
	200	200A	

4.2 Typical Current Pulse Forms, L-Version

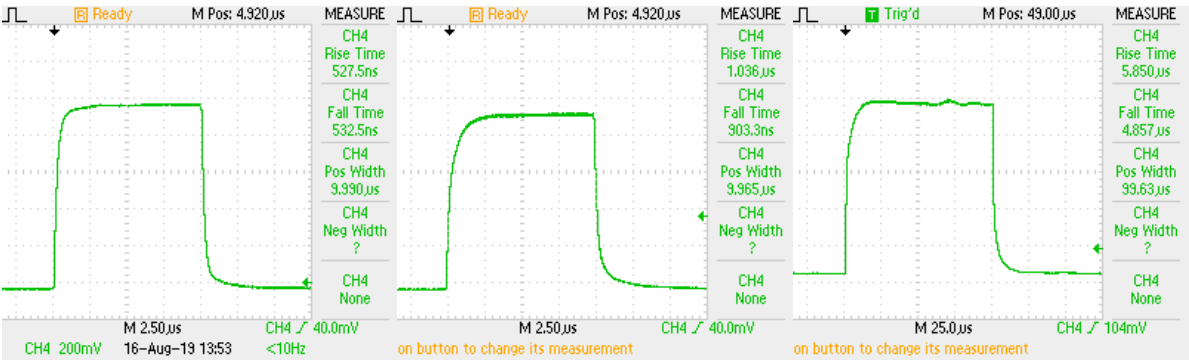


Figure 3: LDD100-L200; 200A pulse (10µs); 20A pulse (10µs); 1A pulse (100µs)

Table 3: Ordering Information XL-Version

Full order code: LDD 100-XL **c**

	Options	Description
Maximum current (c):	040	40A
	120	120A
	200	200A
	400	400A
	600	600A

4.3 Typical Current Pulse Forms, XL-Version

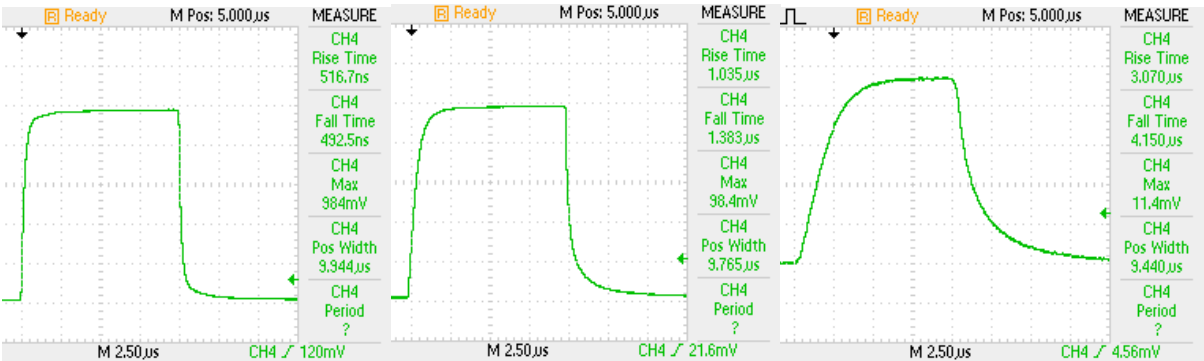


Figure 4: LDD100-XL200; 10µs, 200A pulse; 20A pulse; 2A pulse

For customized or OEM systems, please contact us.

5 Specifications

5.1 Specifications: LDD100-F040

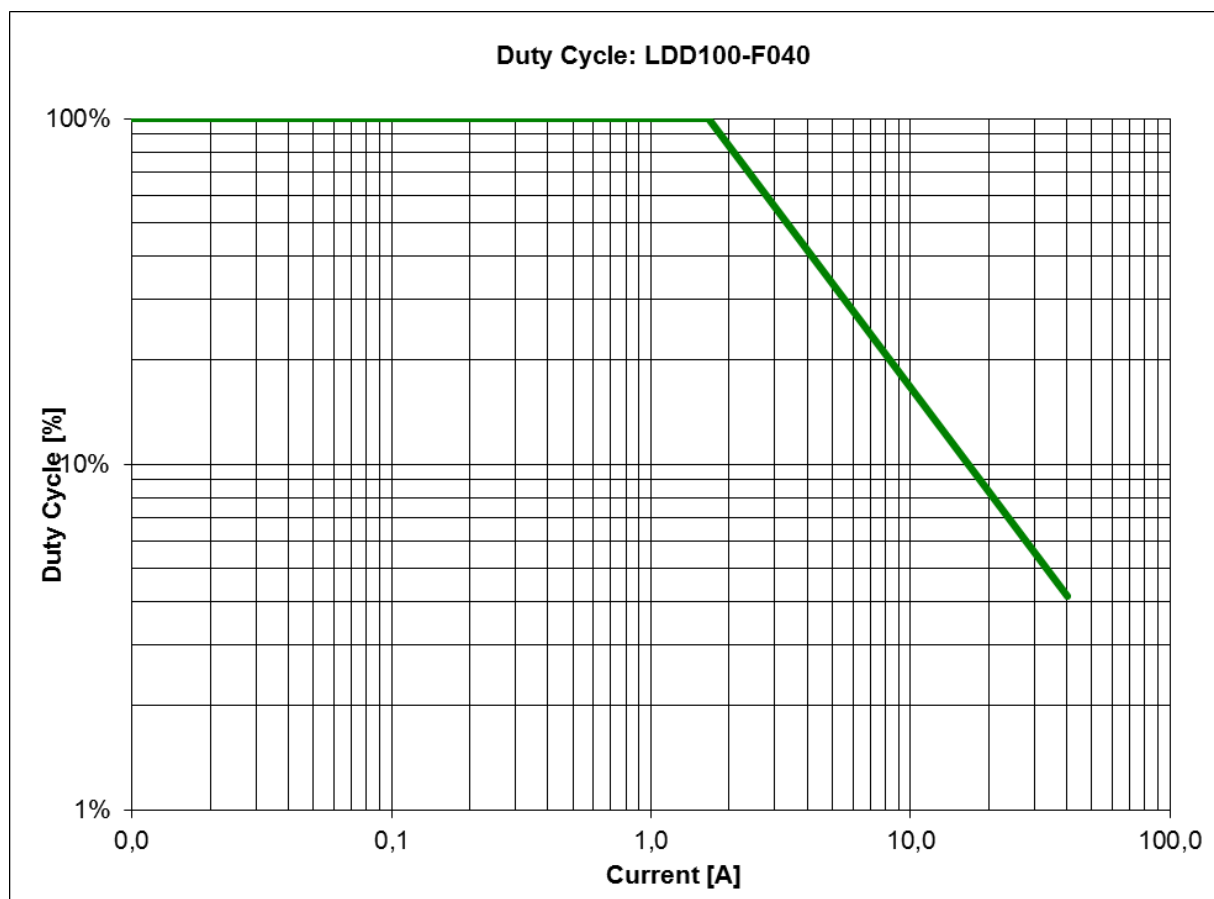
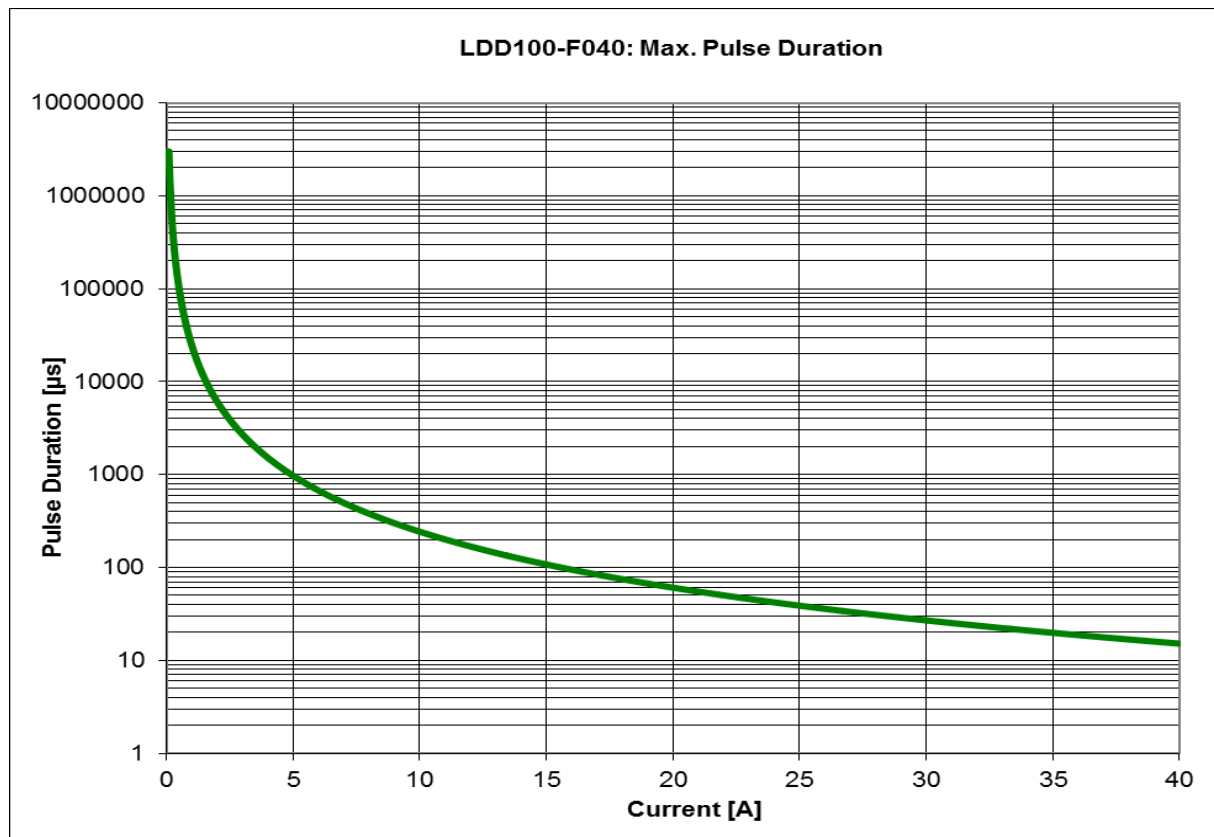
Table 4: Specifications LDD-F040

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	2μs pulse duration	200		40	mA A
Bias current		10		1000	mA
Current resolution		10			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹			70	100	ns
Pulse duration ²		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		20	V
Duty cycle ¹				2.1	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 245 x 155 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹ At 40A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

² Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.1.1 Safe Operating Area (LDD100-F040)



5.2 Specifications: LDD100-F120

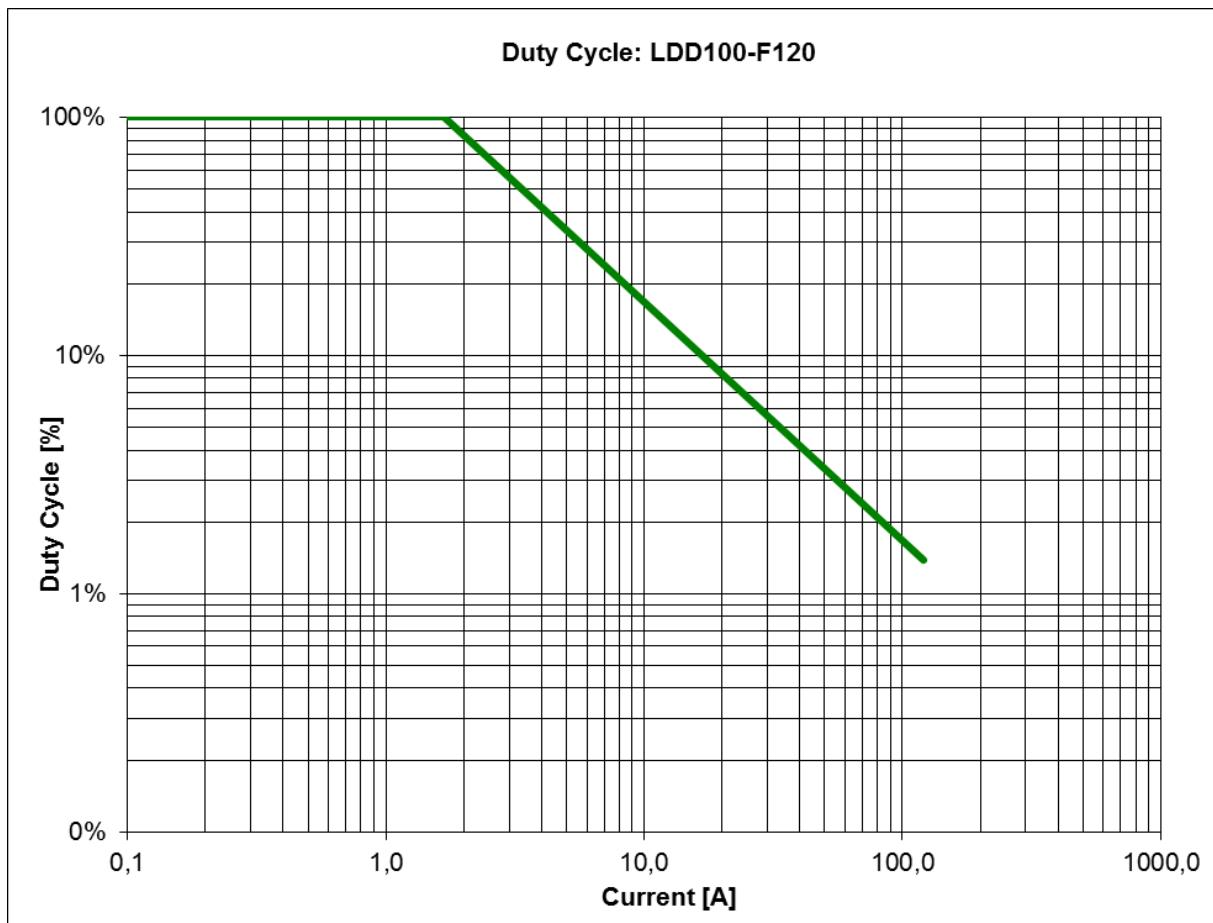
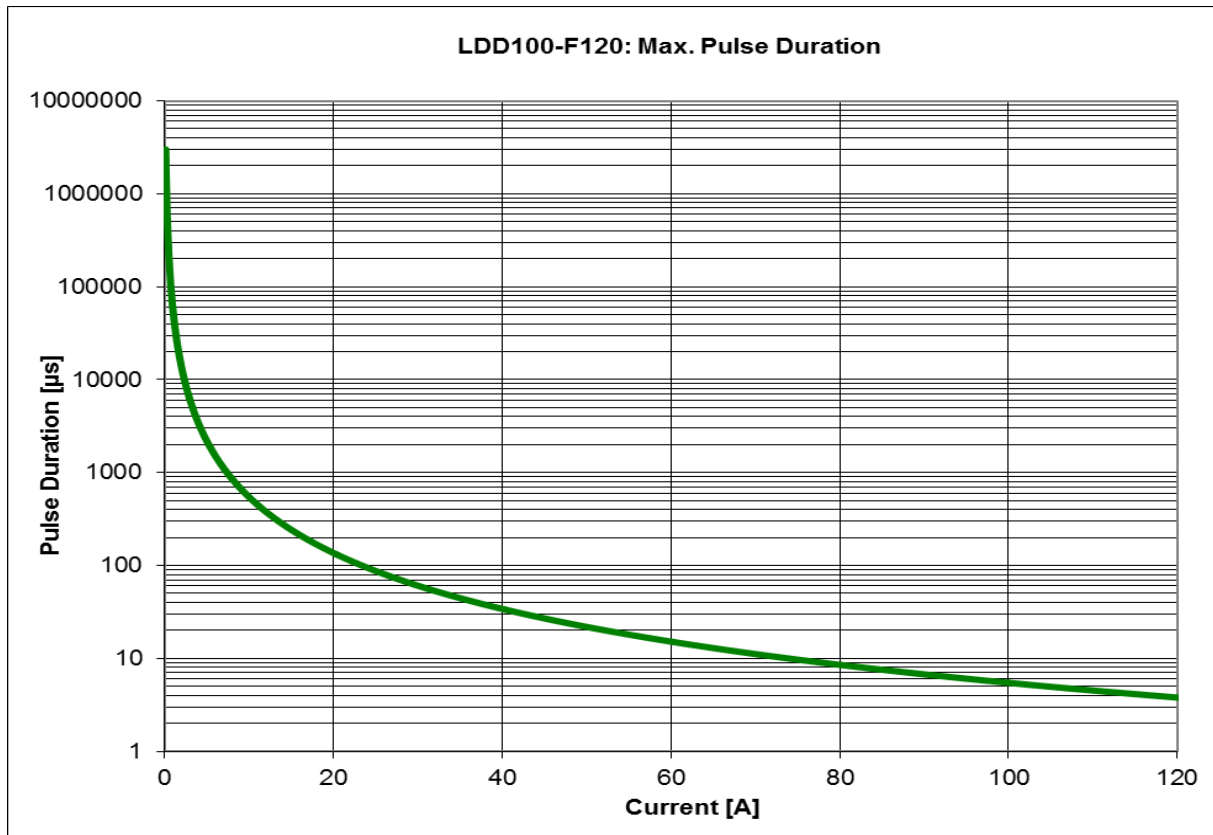
Table 5: Specifications LDD-F120

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	2μs pulse duration	600		120	mA A
Bias current		30		1000	mA
Current resolution		30			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ³			70	100	ns
Pulse duration ⁴		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		20	V
Duty cycle ³				0.7	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

³ At 120A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

⁴ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.2.1 Safe Operating Area (LDD100-F120)



5.3 Specifications: LDD100-L040

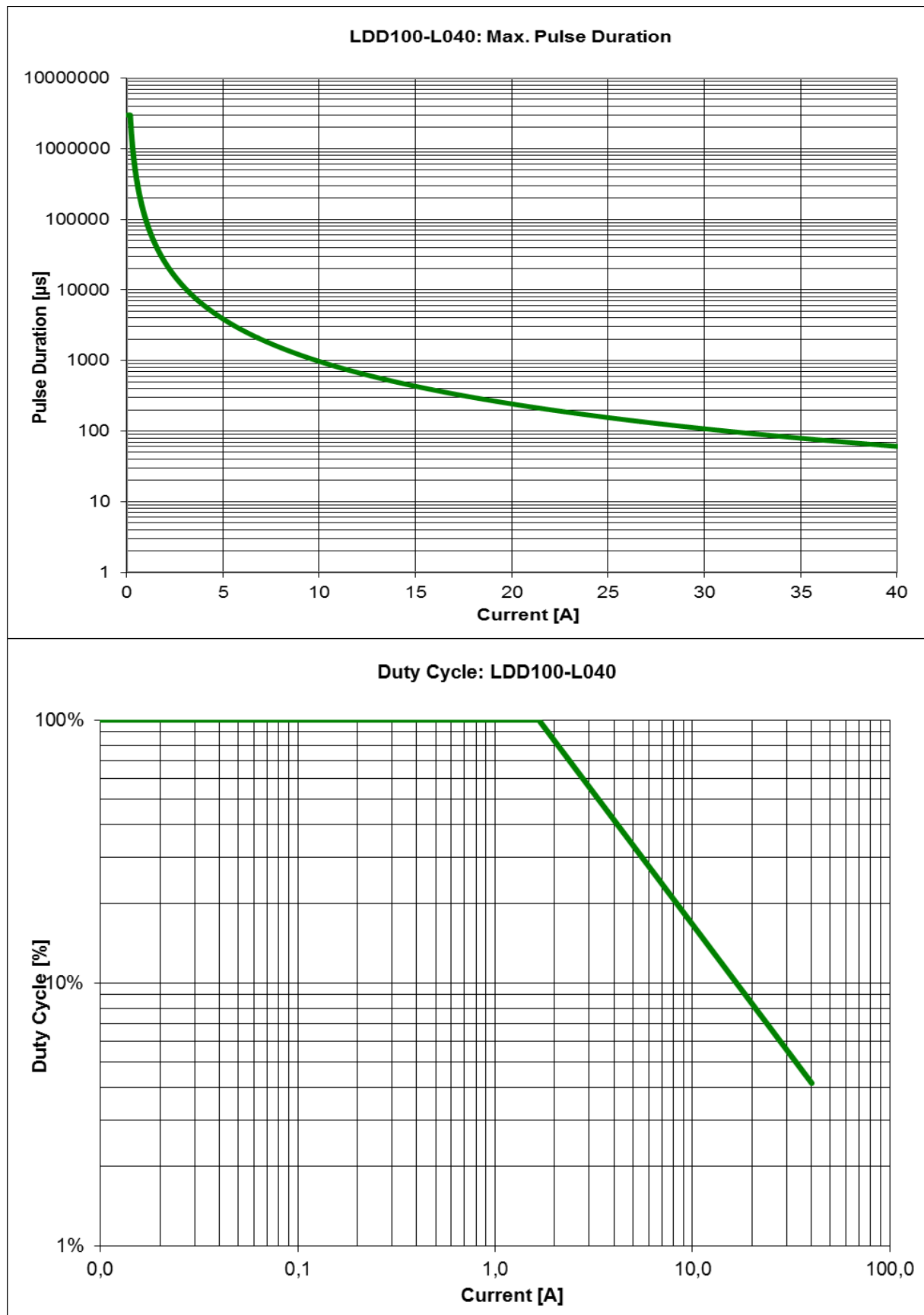
Table 6: Specifications LDD-L040

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	5 μs pulse duration	200		40	mA A
Bias current		10		1000	mA
Current resolution		10			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ⁵			400	600	ns
Pulse duration ⁶		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ¹¹				4.2	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

⁵ At 40A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

⁶ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.3.1 Safe Operating Area (LDD100-L040)



Specifications: LDD100-L120

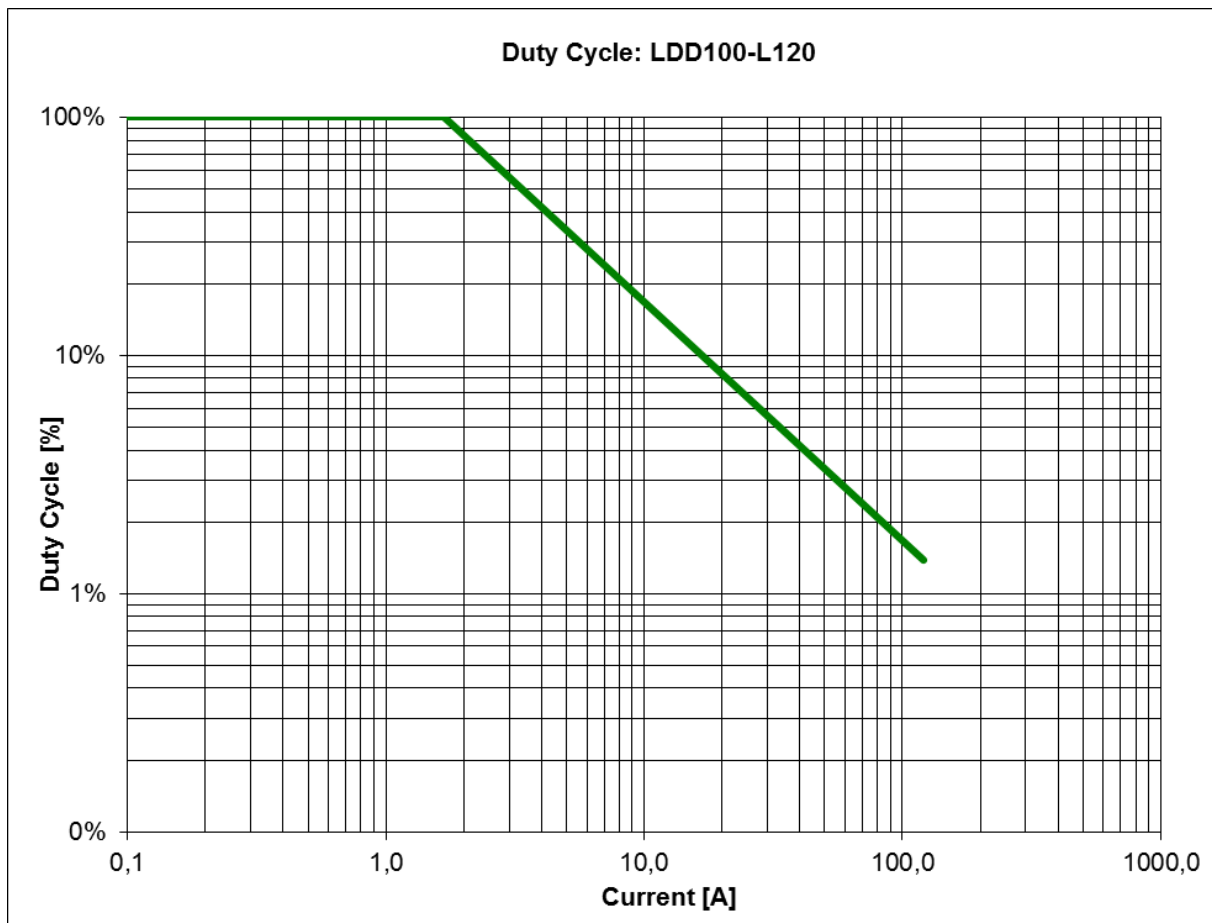
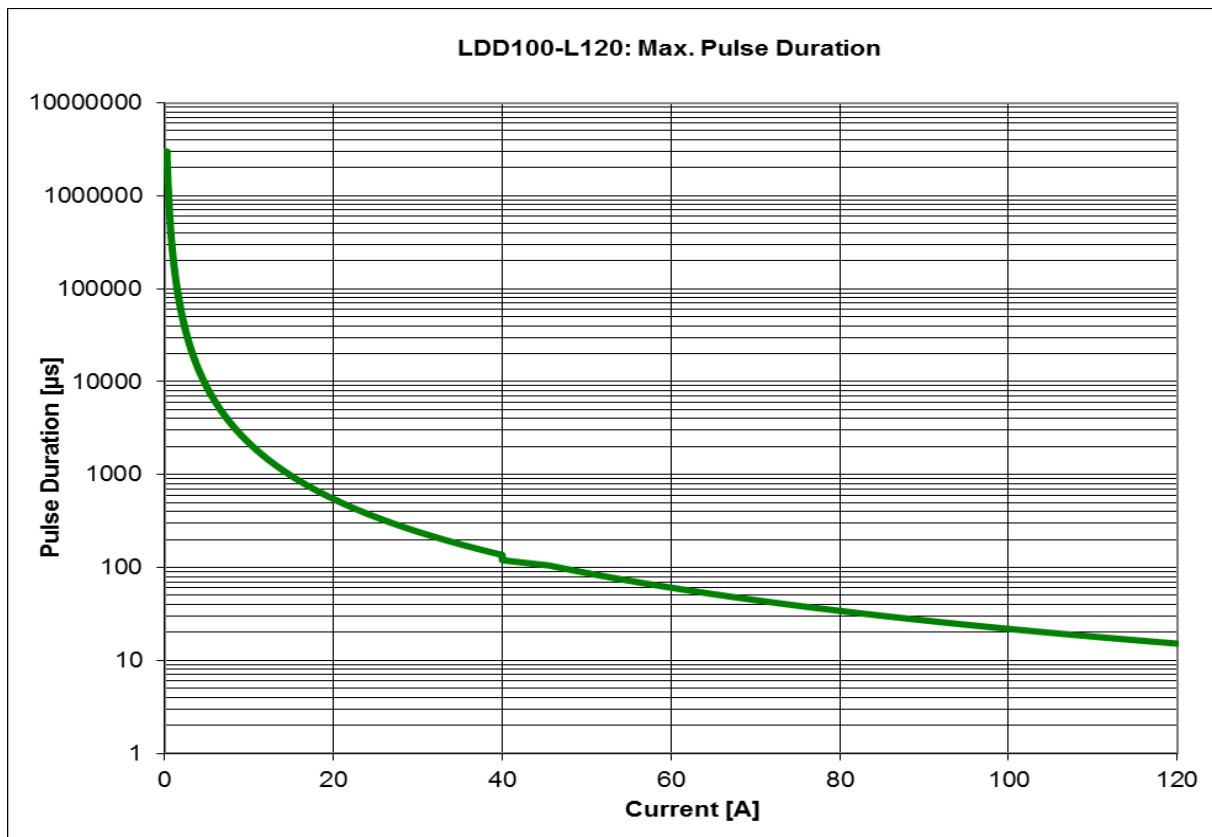
Table 7: Specifications LDD-L120

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	5 μs pulse duration	600		120	mA A
Bias current		10		1000	mA
Current resolution		10			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ⁷			400	600	ns
Pulse duration ⁸		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ¹¹				1.4	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

⁷ At 120A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

⁸ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.3.2 Safe Operating Area (LDD100-L120)



5.4 Specifications: LDD100-L200

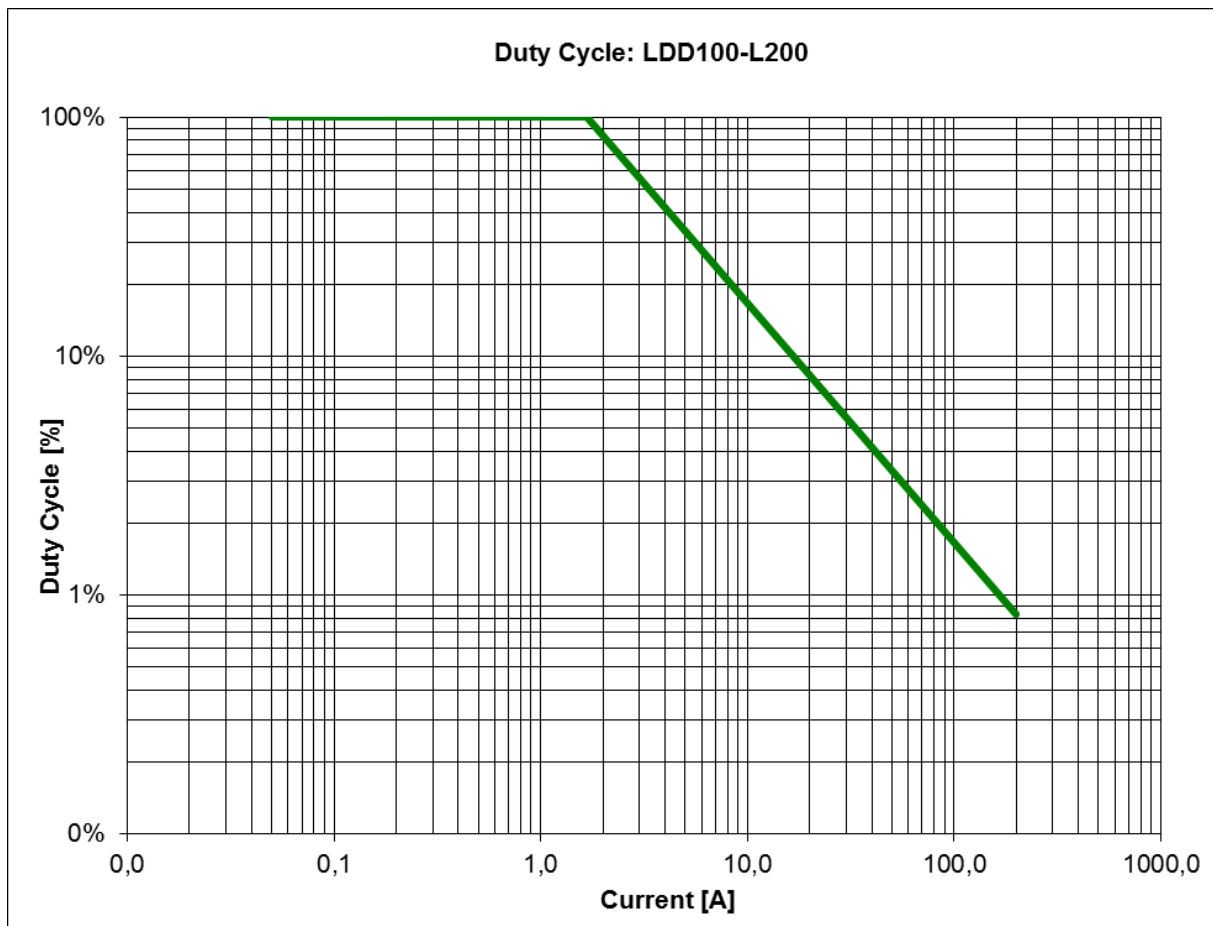
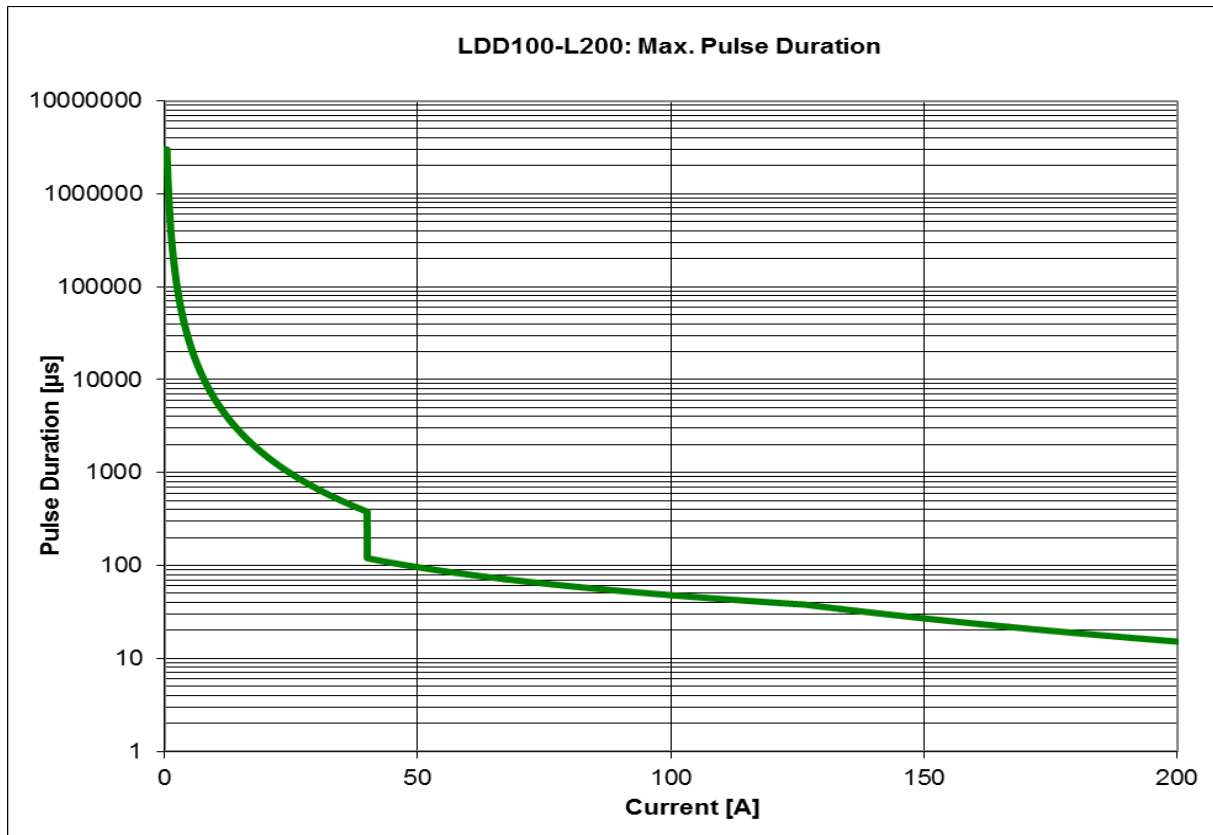
Table 8: Specifications LDD-L200

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	5 μs pulse duration	1		40	A A
Bias current		10		1000	mA
Current resolution		10			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ⁹			400	600	ns
Pulse duration ¹⁰		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ¹¹				0.8	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

⁹ At 200A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

¹⁰ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.4.1 Safe Operating Area (LDD100-L200)



5.5 Specifications: LDD100-XL040

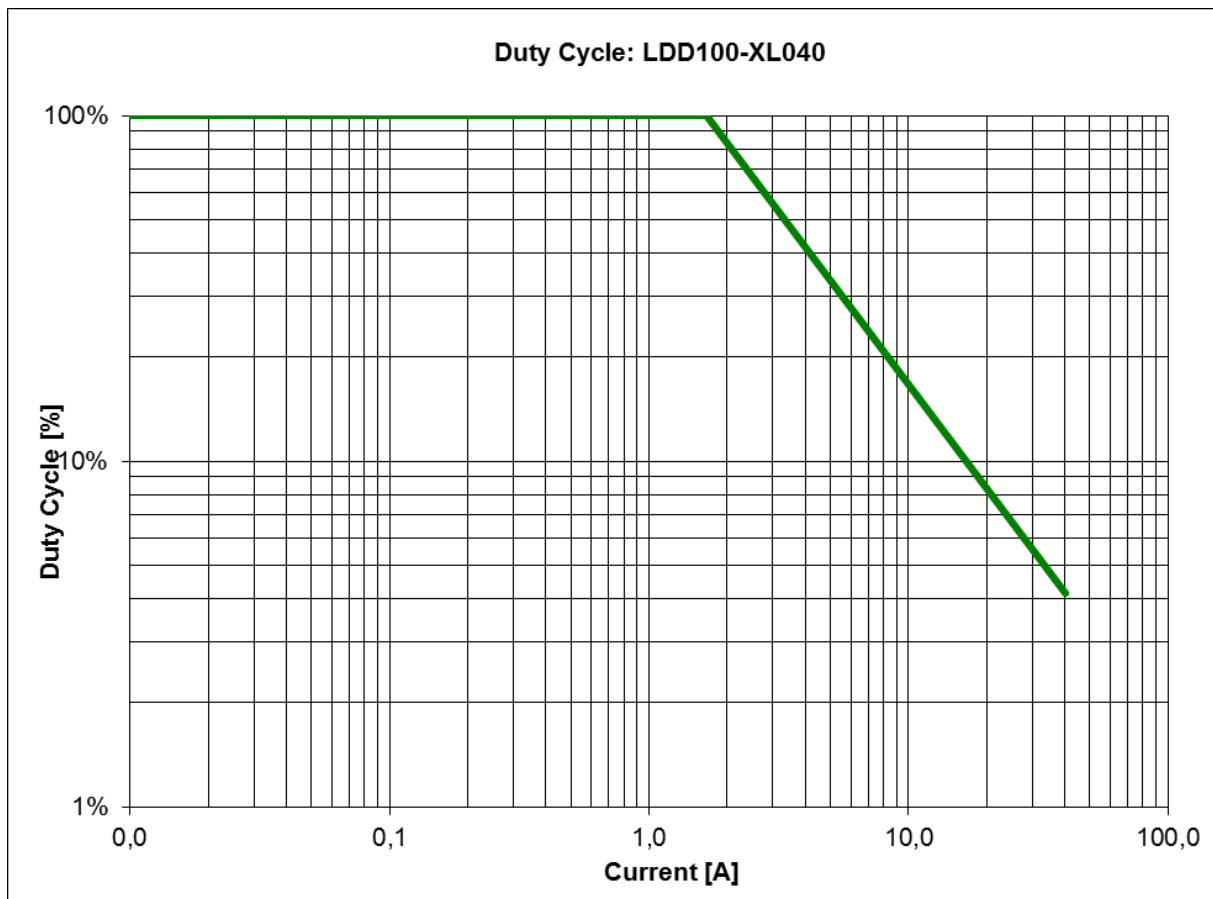
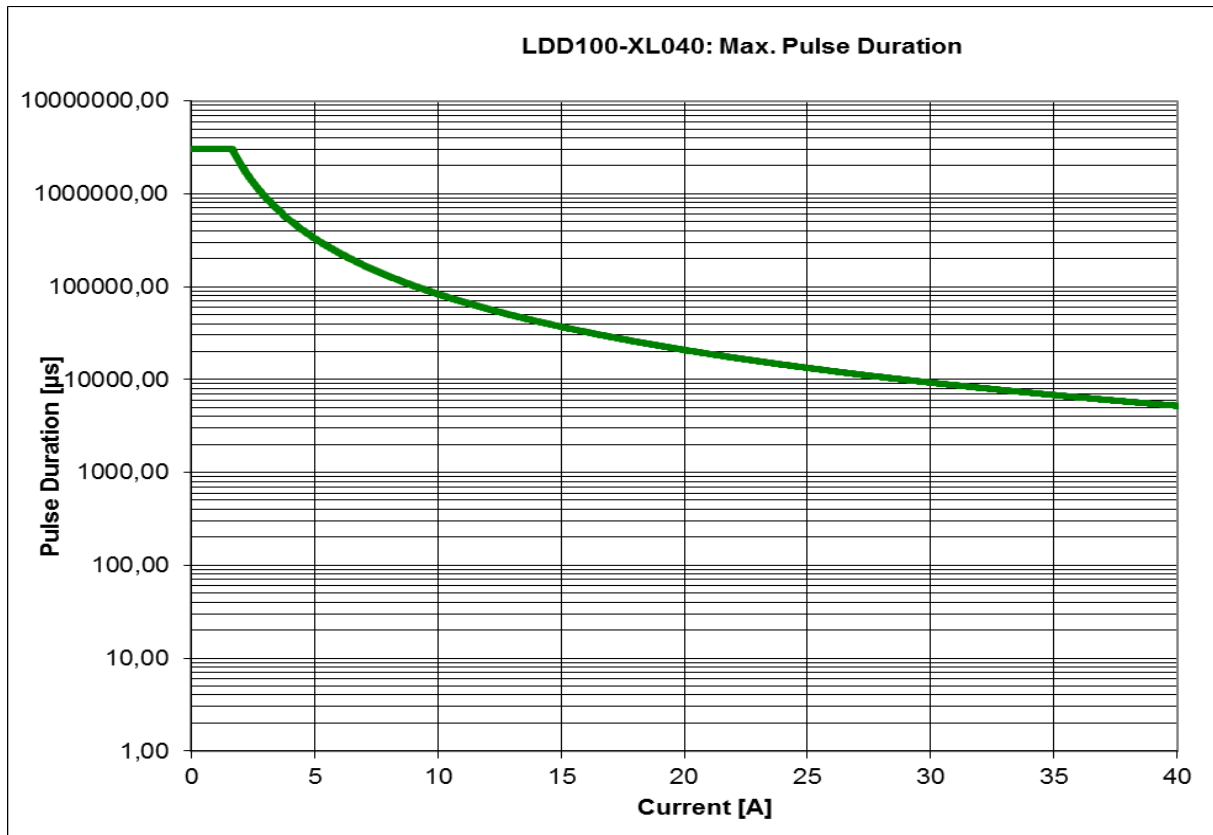
Table 9: Specifications LDD-XL040

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	10 μs pulse duration	200		40	mA A
Bias current		10		1000	mA
Current resolution		10			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹¹			1.5	3	μs
Pulse duration ¹²		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ¹¹				4.2	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹¹ At 40A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

¹² Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.5.1 Safe Operating Area (LDD100-XL040)



5.6 Specifications: LDD100-XL120

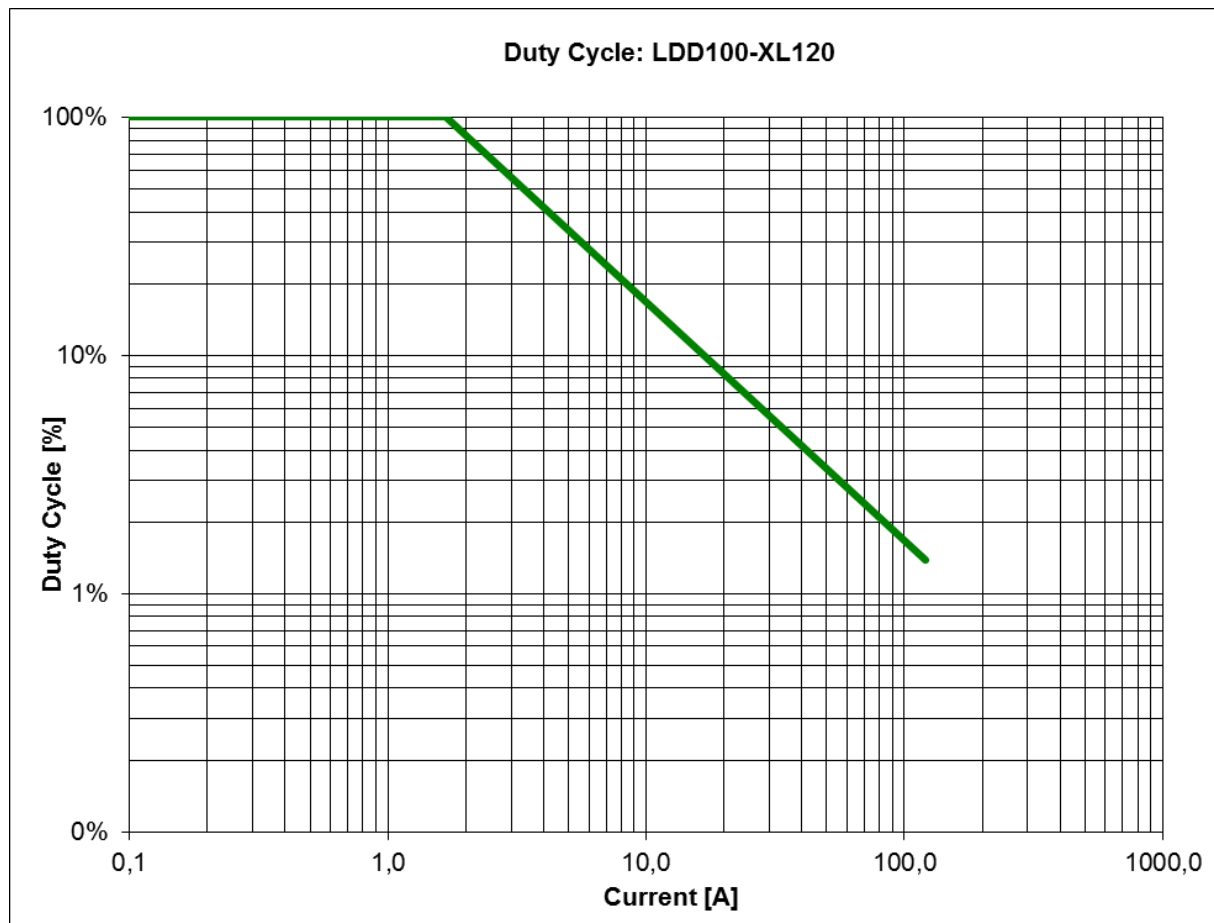
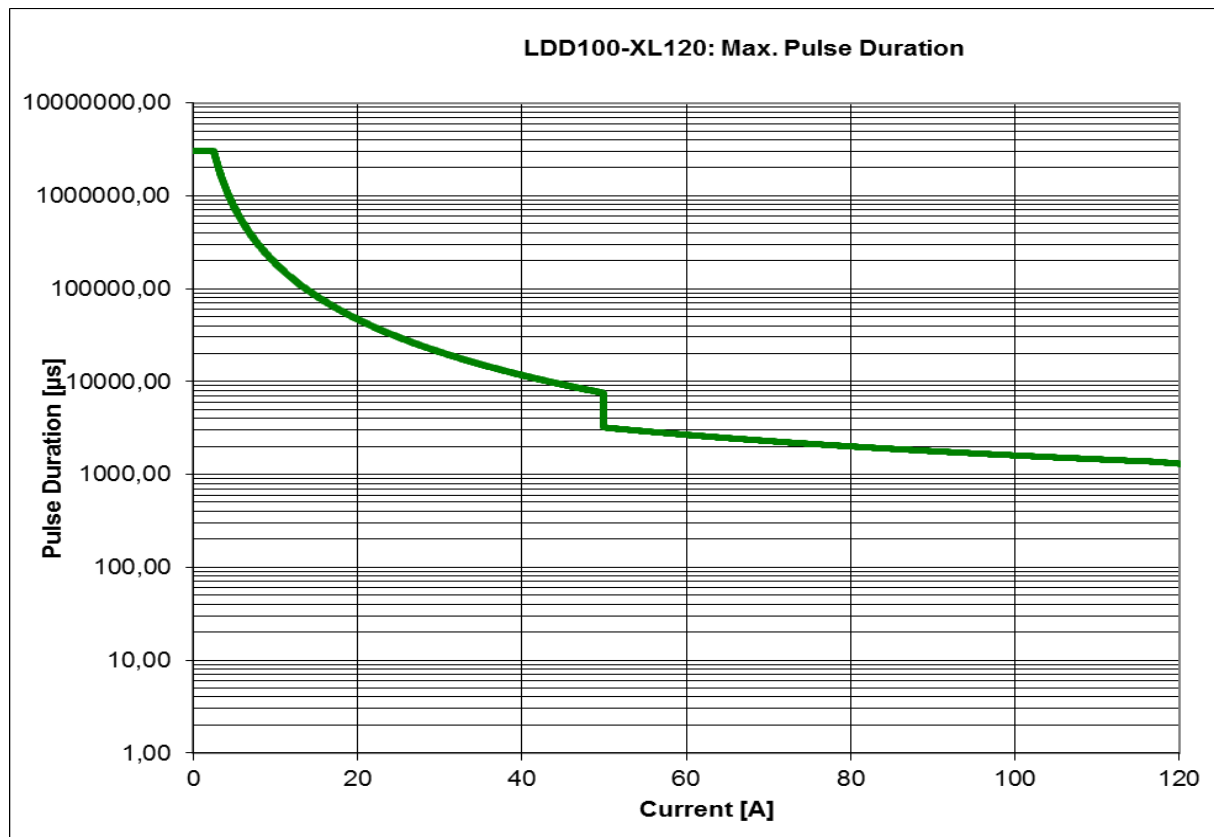
Table 10: Specifications LDD-XL120

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	10µs pulse duration	600		120	mA A
Bias current		30		2000	mA
Current resolution		30			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹³			1.5	3	µs
Pulse duration ¹⁴		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	µs s
Resolution of pulse separation	10µs to 100ms 100ms to 1s 1s to 10s	10	100	1	µs µs ms
Compliance voltage		8		10	V
Duty cycle ³				1.4	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹³ At 120A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

¹⁴ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.6.1 Safe Operating Area (LDD100-XL120)



5.7 Specifications: LDD100-XL200

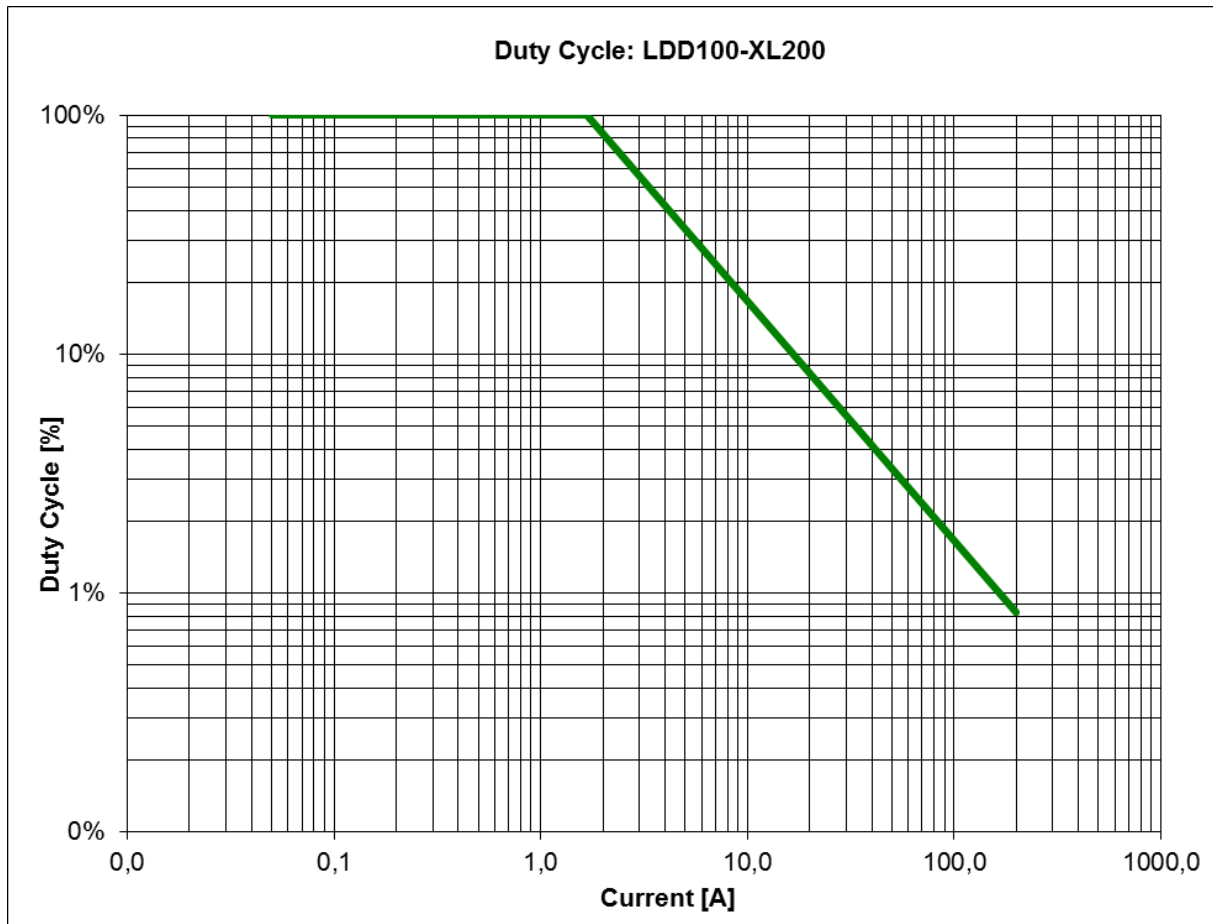
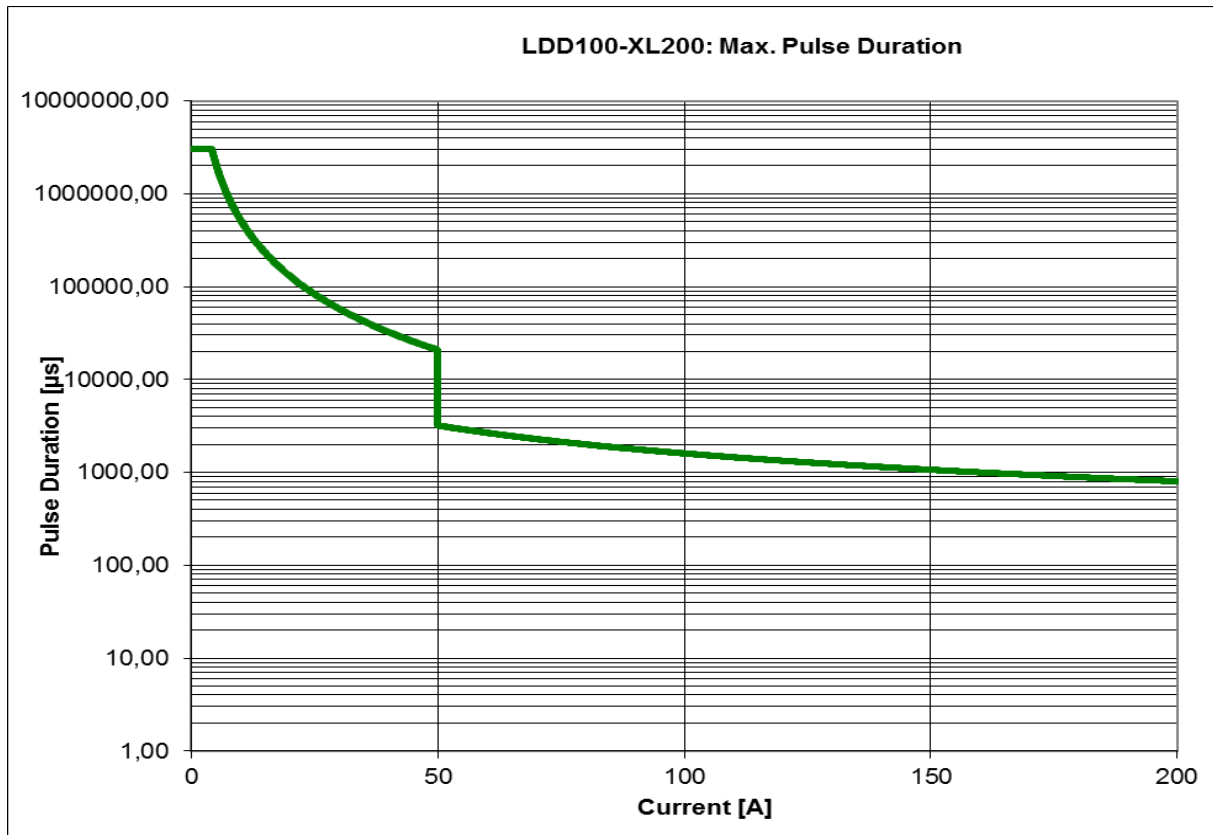
Table 11: Specifications LDD-XL200

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	10μs pulse duration	1		200	A A
Bias current		50		2000	mA
Current resolution		50			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹⁵			1.5	3	μs
Pulse duration ¹⁶		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ³				0.8	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹⁵ At 200A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

¹⁶ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.7.1 Safe Operating Area (LDD100-XL200)



5.8 Specifications: LDD100-XL400

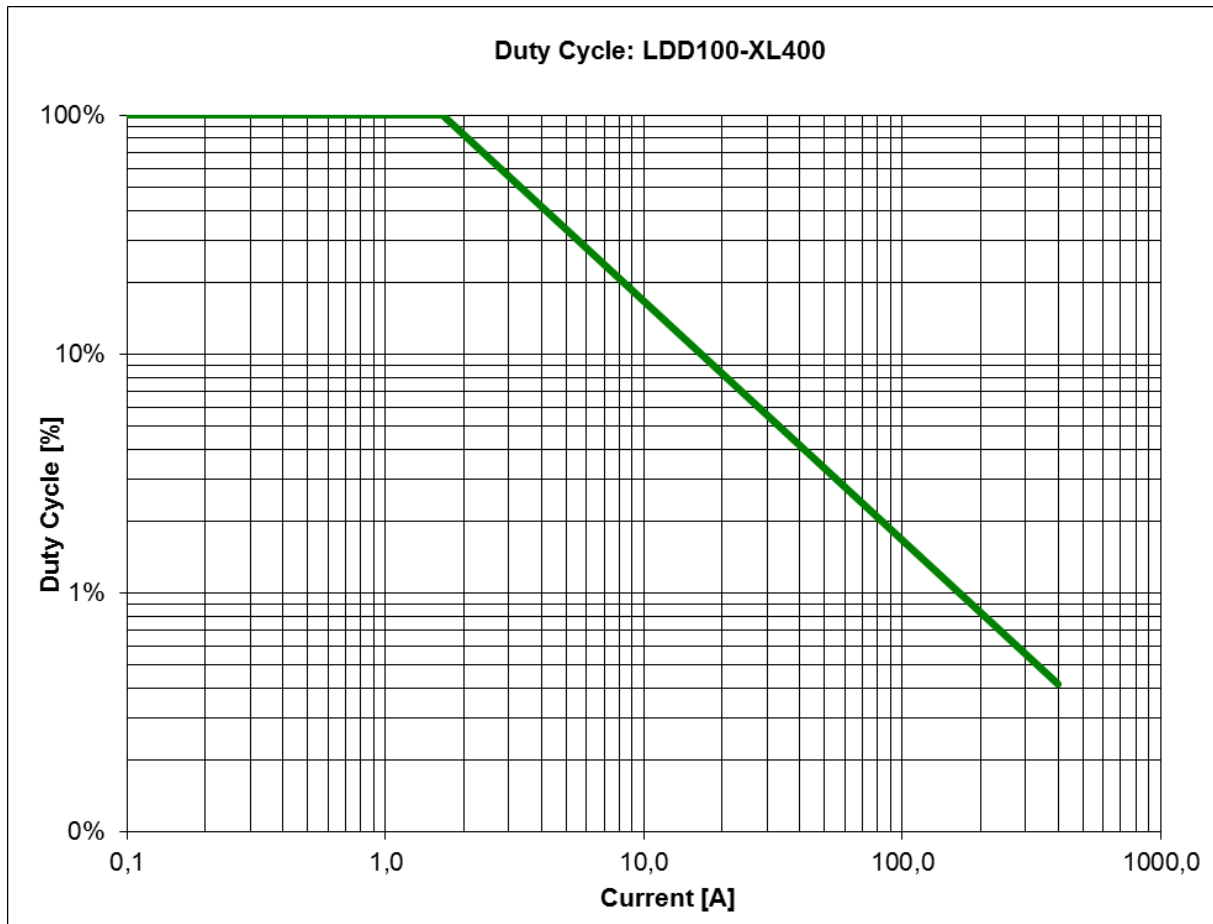
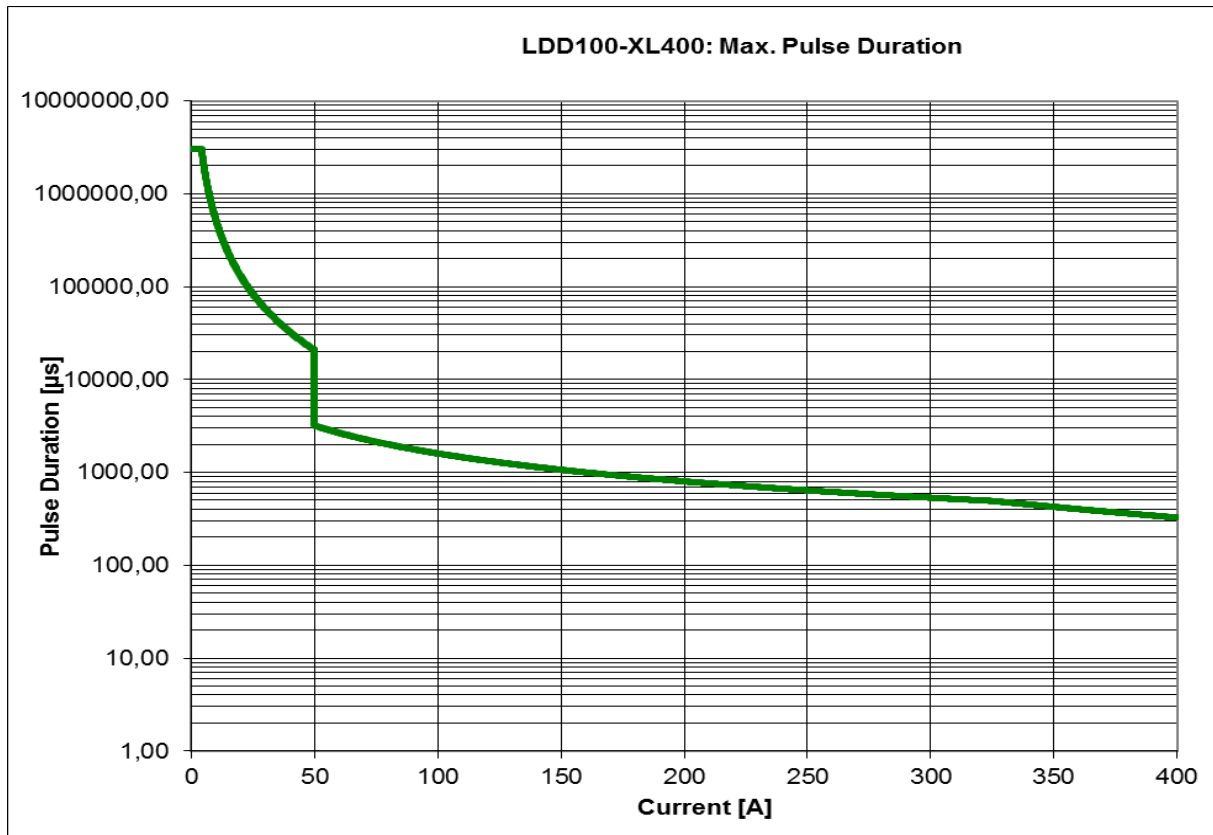
Table 12: Specifications LDD-XL400

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	10μs pulse duration	2		400	A A
Bias current		100		2000	mA
Current resolution		100			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹⁷			1.5	3	μs
Pulse duration ¹⁸		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ³				0.4	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹⁷ At 400A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

¹⁸ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.8.1 Safe Operating Area (LDD100-XL400)



5.9 Specifications: LDD100-XL600

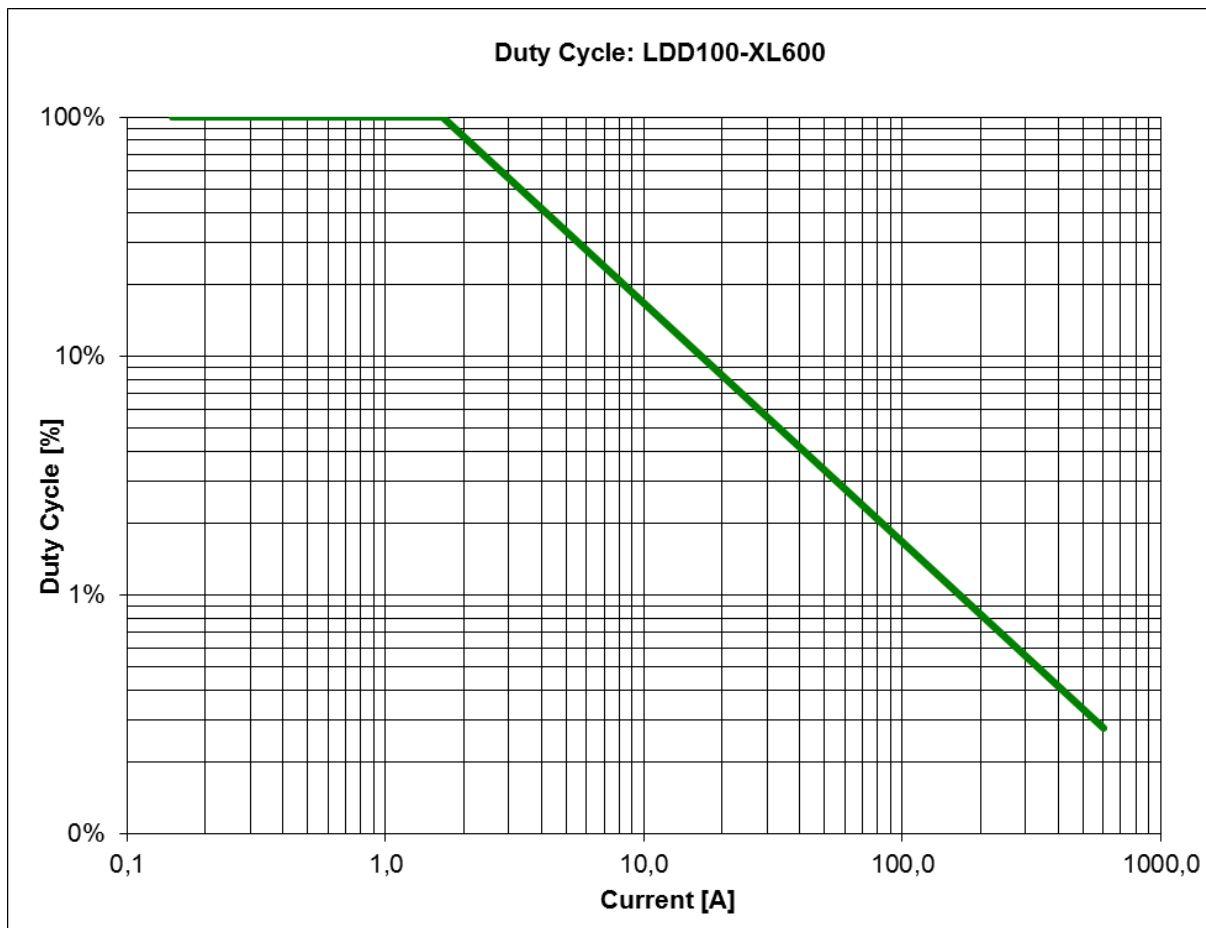
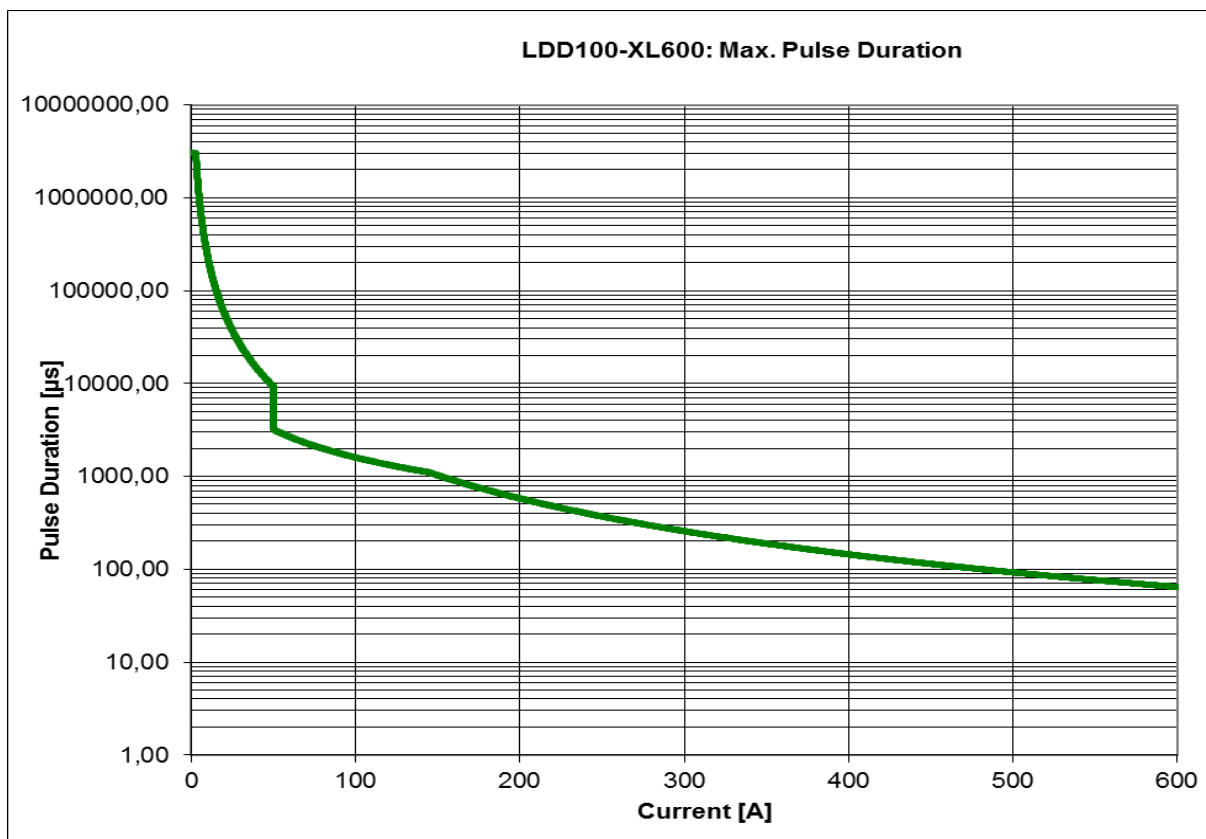
Table 13: Specifications LDD-XL600

PARAMETER	CONDITIONS				UNITS
		MIN	TYP	MAX	
OUTPUT					
Current	10μs pulse duration	3		600	A A
Bias current		100		2000	mA
Current resolution		100			mA
Connector	Control unit to head Head to laser	LEMO Strip line			
Rise time / Fall time ¹⁹			1.5	3	μs
Pulse duration ²⁰		50		3	ns s
Resolution of pulse duration	50ns to 1.5ms 1.5ms to 3s	50		0.01	ns %
Repetition rate				100	kHz
Pulse separation		10		10	μs s
Resolution of pulse separation	10μs to 100ms 100ms to 1s 1s to 10s	10	100	1	μs μs ms
Compliance voltage		8		10	V
Duty cycle ³				0.28	%
Accuracy			± 0.2	± 0.5	%
PC INTERFACE					
Type		USB 2.0			
Data transfer rate		1.5			Mbit/s
TRIGGER					
Type		Internal External: sequence start External: individual pulse control			
POWER SUPPLY					
Voltage input		88 – 264			VAC
Frequency		47 – 63			Hz
Power factor		0.95			
DIMENSIONS					
	Control unit Current head	250 x 235 x 150 mm (W x L x H) 105 x 190 x 55 mm (W x L x H)			mm mm

¹⁹ At 600A with optimized, short strip line connection. See “SOA” graphs overleaf for full details.

²⁰ Maximum dependant on set current. See “SOA” graphs overleaf for full details. Minimum pulse duration will not reach full set current due to rise time limitations.

5.9.1 Safe Operating Area (LDD100-XL600)



5.10 Case Dimensions (mm [inch])



6 Connections

6.1 Front Panel (Control Unit)



Figure 5: Front Panel

6.1.1 Power Switch

The power switch activates the internal power supply for the control unit. The control unit is active, but not enabled to drive current unless the key switch is also turned on.

6.1.2 Key Switch (Laser Enable)

The key switch enables and disables the current driver. This is a safety feature.

6.1.3 Interlock (red LED)

The “Interlock” LED indicates that the interlock is open. The interlock must be closed in order to run the instrument. See also 6.2.6 “Interlock”, pg.47.

6.1.4 Excess Temperature (red LED)

The “Temperature” LED indicates that the current driver end stage has exceeded its maximum operating temperature and has shut down. The system must be fully powered off and restarted in order to reactivate the end stage unit.

6.1.5 Up and Down Buttons

These buttons are used to navigate through menus and to change boolean values within menus such as on/off.

6.1.6 Numeric Keypad

The keypad is used to enter parameter values within the setup menus.

6.1.7 Enter Button

The “Enter” button has two uses:

- to activate the editing mode of a given parameter in the setup menus
- to accept the input parameter value and exit the editing mode of that parameter

6.1.8 Cancel Button

The “Cancel” button exits a menu position without changing the present value of the respective parameter.

6.1.9 OLED Display

The OLED display shows the current status, parameter values and under certain circumstances also warning messages.

6.1.10 Stop Button

The “Stop” button immediately stops the current driver and aborts the present running sequence. This button also serves the safety purpose of the “emergency off”.

6.1.11 Start/Pause Button

The “Start/Pause” button has two uses:

- to activate a current driving sequence
- to pause the present running sequence. When pressed during a sequence, the “Stop” button will blink (red) until the sequence is continued (by pressing the “Start/Pause” button again) or until the sequence is aborted (by pressing the “Stop” button).

6.2 Back Panel (Control Unit)



Figure 6: Back Panel

6.2.1 Power Supply

This receptacle connects the mains power input to the control system. The input block contains a slow blow fuse which may be replaced by the user if required.

The internal universal switching power supply is mains input rated at 85-264VAC, 48-62Hz. The mains input cable to the power supply may be removed and replaced with an appropriate cable to fit the mains receptacle in the country of use.

6.2.2 Laser Head Power

This receptacle connects the DC power input to the current driver end stage head. The connector is key coded to prevent insertion in the wrong direction. The red marks on the connector and the receptacle must be aligned in order to insert the connector.

6.2.3 Laser Head Communication

This receptacle connects the communication lines to the current driver end stage head. The connector is key coded to prevent insertion in the wrong direction. The red marks on the connector and the receptacle must be aligned in order to insert the connector.

6.2.4 Signal Lamp

This multi-pole receptacle is for driving the externally mountable safety indicator lamp. This lamp lights green when the driver is not enabled, yellow when the driver is enabled but not running and red when the current driver is running.

6.2.5 USB

The communication with the LDD100 is via USB 2.0 with a baud rate of 1 000 000 bit/s. A hardware-handshake using RTS/CTS is employed to ensure secure communication. The appropriate USB cable is supplied with the system. The standard cable length is 2m. A 5m cable may be supplied upon request.

6.2.6 Interlock

This receptacle may be used to connect to an external safety interlock system such as a door switch. The two terminals of this receptacle must be shorted in order to activate the system. A shorting block is delivered with the unit to allow use without connecting an external interlock.

6.2.7 Trigger Out

This BNC receptacle may be used for synchronizing external instruments such as a power meter or a spectrometer. The output is TTL compatible: HI=+5V; LO=0V. The output is HI when current is driven and LO when not. Several external instruments may be connected to this receptacle by use of T- or Y-adapters. The outer electrode (shield electrode) is at the internal ground potential of the LDD100 instrument. Only instruments at the same ground potential may be connected to this receptacle.

NOTICE!



Note that neither end of the DUT is at ground potential!

The DUT connected to the current output receptacle of the LDD100 is at a floating, high potential. The anode of the DUT is at the potential of the power supply (typically +12V or +24V). The cathode of the DUT is actively “pulled down” when driving current to the potential required to drive the current in question. Thus, it is not possible to connect a single-ended oscilloscope probe to the DUT and trigger the oscilloscope from the “Trigger Out” receptacle. Doing so will cause a short circuit and may damage the power supply and/or the LDD100 unit.

6.2.8 Trigger In

This BNC receptacle may be used for externally activating the current driving sequence.

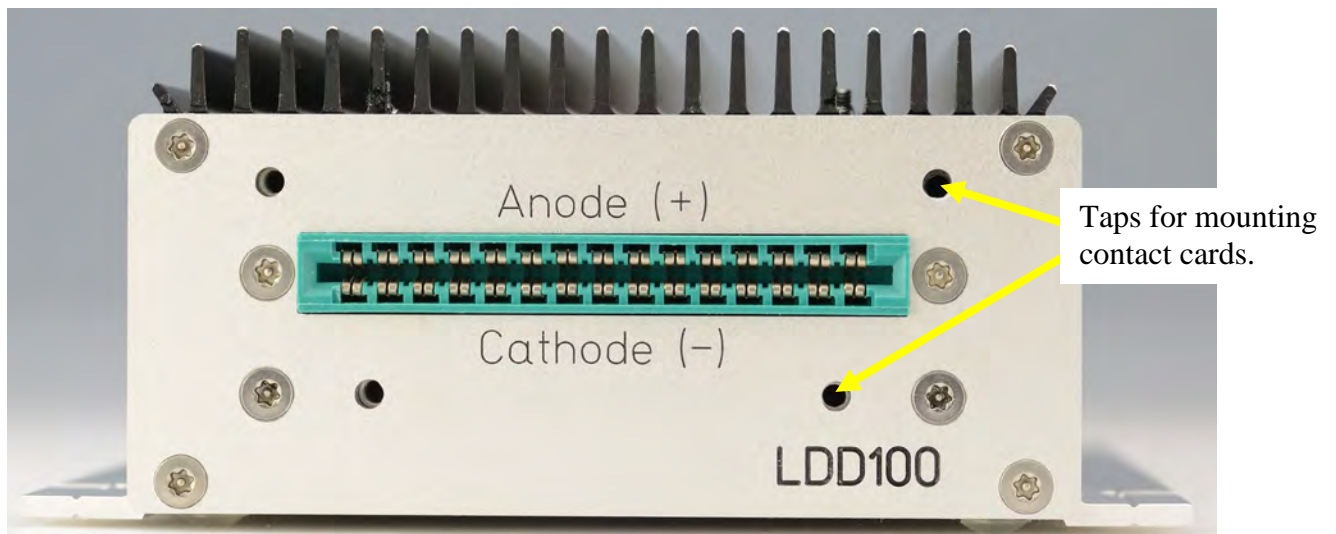
NOTICE!



Note that neither end of the DUT is at ground potential!

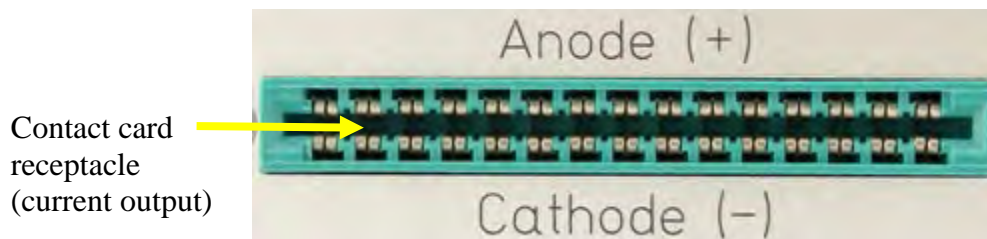
The DUT connected to the current output receptacle of the LDD100 is at a floating, high potential. The anode of the DUT is at the potential of the power supply (typically +12V or +24V). The cathode of the DUT is actively “pulled down” when driving current to the potential required to drive the current in question. Thus, it is not possible to connect a single-ended oscilloscope probe to the DUT and trigger the oscilloscope from the source connected to the “Trigger In” receptacle. Doing so will cause a short circuit and may damage the power supply and/or the LDD100 unit.

6.3 Front Panel (Current Driver End Stage Unit)



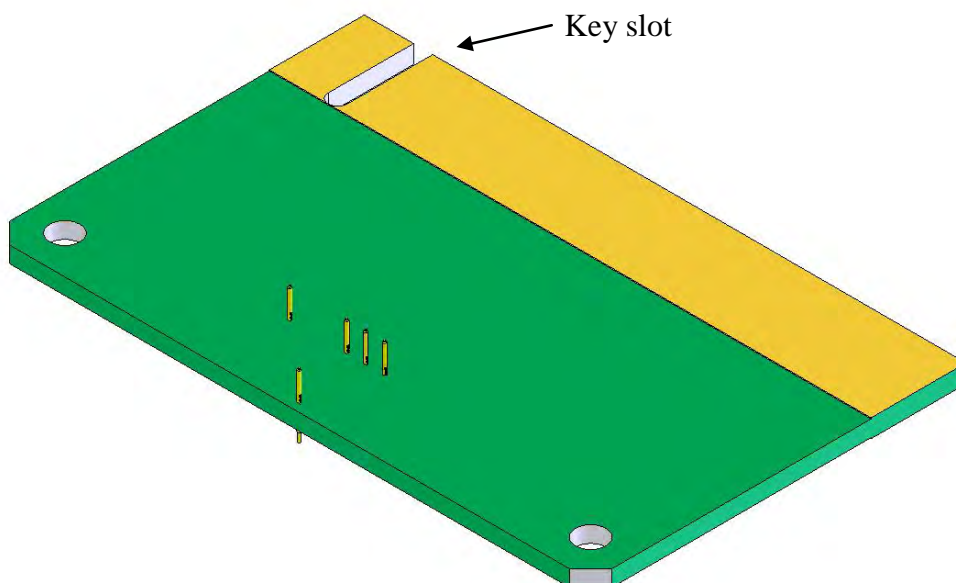
6.3.1 Current Output

The current output to drive the DUT is delivered from the slot receptacle.



Artifex Engineering provides full support to design and manufacture custom strip line contact cards for contacting laser bars, chips, TO, C-Mount, CS-Mount, etc. Contact us for your requirements.

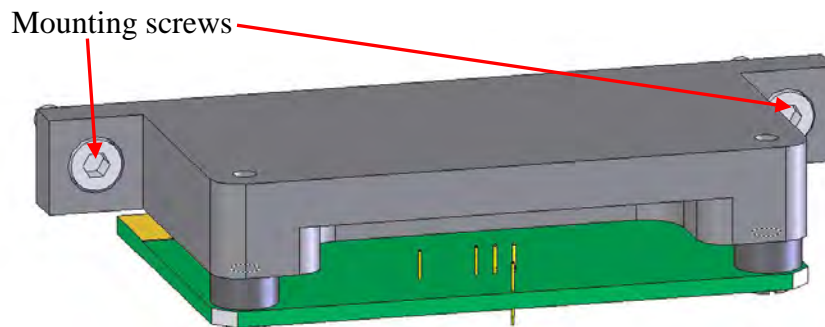
The contact card is inserted into the card receptacle with the key slot on the left hand side of the receptacle. The correct polarity is guaranteed through the key slot in the card.



**NOTICE!**

The needles and pogo pins (laser contact pins) are sensitive. Do not touch the pins with your fingers or tools under any circumstance.

The contact card is fitted with a card support when delivered. If for any reason you need to exchange cards on the support, remove the two screws holding the card support to the LDD unit and remove the complete card assembly in order to change cards.



Now turn the card holder over and remove the two screws holding the card onto the card holder.

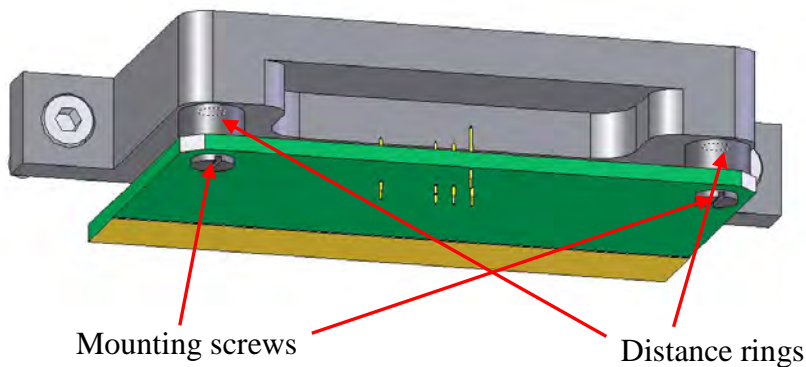


Figure 7: Mounting a New Contact Card

When reassembling, be sure the distance rings between the contact card and the card holder are in place.

6.4 Back Panel (Current Driver End Stage Unit)



Figure 8: Back Panel

6.4.1 Communication

This receptacle connects the communication lines to the current driver end stage head. The connector is key coded to prevent insertion in the wrong direction. The red marks on the connector and the receptacle must be aligned in order to insert the connector.

6.4.2 Power

This receptacle connects the DC power input to the current driver end stage head. The connector is key coded to prevent insertion in the wrong direction. The red marks on the connector and the receptacle must be aligned in order to insert the connector.

6.4.3 Monitor Out

This BNC receptacle may be used to monitor the current pulses in real time. The cable connected to this receptacle must be terminated in 50Ω in order to show the true shape of the current pulse.

7 Operation

The LDD100 may be controlled in one of three manners:

1. Control via the real front panel touchpad
2. Control via the virtual graphical user interface supplied with the unit
3. Control via customer own software which may be written around the core dll supplied with the unit

8 Control Via the (Real) Front Panel

The touchpad front panel together with the OLED display on the front panel allow the user to input all relevant parameters to operate the device without computer control. The functionality of the buttons and indicators are described in the section 6.1 “Front Panel (Control Unit)”, pg.44.

8.1 Menu Structure

In the following, the columns “Main menu” and the submenus show what appear on the OLED display in each line. The box outline indicates the full display in each case. The user can navigate these lines using the UP (▲) and DOWN (▼) keys. This results in rolling the menu up or down. Alternatively, the user can just press the number corresponding to the line and the menu is entered directly.

Table 14: Menu Structure (Front Panel Control)

Main menu	Submenu 1	Submenu 2	Submenu 3	Submenu 4	
1/Sequence	1/Parallel	1/Current	1/Max	value + unit	
			2/Min	value + unit	
			3/Bias	value + unit	
		2/No. of steps	value		
			3/No. of cycles	Number	value
				Continuous mode	0=off / 1=on
	2/Serial	1/Current	1/Max	value + unit	
			2/Min	value + unit	
			3/Bias	value + unit	
		2/No. of steps	value		
			3/No. of cycles	Number	value
				Continuous mode	0=off / 1=on
	3/Pulse	1/Current	value + unit		
			2/Bias	value + unit	
		3/No. of cycles	Number	value	
			Continuous mode	0=off / 1=on	
2/Trigger	1/Ext TRG				
	2/Int. TRG				
3/Pulse Timing	1/Width	value + unit			
	2/Period	value + unit			
	3/Separation	value + unit			
	4/Repetition rate	value + unit			
4/Extras	1/Current Limit	value + unit	number (0-9)		
	2/Setup Profiles	1/Store			
		2/Recall			
		3/ Delete			
		4/ List			
3/Show Parameters	3 page list of values. Scroll pages with UP and DOWN keys				

When the instrument is first turned on, the user will be prompted to enter the current limit. This is a safety feature to prevent damage of devices which cannot withstand the full current capability of the instrument.

Following this, the OLED displays the following menu:

```
1/Sequence
2/Trigger
3/Pulse Timing
4/Extras
```

Using the UP (▲) and DOWN (▼) keys to highlight a menu and then pressing the “Enter” key or selecting a menu number (eg: “2” will enter the “Trigger” menu) now enters a main menu and shows the available submenu. Each submenu is designed to have only 4 selections, so that no scrolling is necessary or possible. For example, entering the main menu “Sequence” results in the following display:

```
1/Parallel
2/Serial
3/Pulse
```

From here, entering “1/Parallel” results in the following display:

```
1/Current
2/No. of steps
3/No. of cycles
```

From here, entering “1/Current” results in the following display:

```
1/Max
2/Min
3/Bias
```

From here, entering “1/Max” results in the following display:

```
<present value> <present units>
```

For example:

```
100000 mA
```

In order to edit the present value, press “Enter”. The user can now enter a number and units here. The “Enter” key then brings the display back to the previous submenu.

In any given submenu, the “Cancel” button brings the display up one menu level.

The most recent active parameters are automatically saved into a “default” non-volatile memory when exiting a menu point or when starting a sequence. The user may begin a pulsing sequence from any main menu or submenu as long as that menu is not in edit mode. That is, as soon as the last parameter has been entered, the sequence may be started.

When the instrument is shut down, the most recent active parameters are also automatically saved into a “default” non-volatile memory. Thus, when starting the instrument, the last used parameter set is automatically loaded.

Additionally, the user may store or recall a setup profile into numerated non-volatile memories via the menu “Setup Profiles”. A total of 10 user defined profiles may be stored in this manner. These files are stored internally as setup 0 to setup 9. However, the user can give the files useful names by keying in a name using the numeric keypad in the same manner as texting with a cell phone. When a number is pressed, the first letter associated with that number is shown. Using the UP (▲) and DOWN (▼) keys, the letters associated with that number are scrolled through in sequence. For example, pressing “7” results in “p”. Pressing the UP (▲) or DOWN (▼) button repeatedly scrolls through the options as follows: “q”, “r”, “s”, “7” and then comes back to “p”.

9 Installation of the Software Package

The installation of the software package is described in a separate document provided with the instrument.

10 Using the GUI Application Software

The graphical user interface is simple and easy to use. All of the important features can be reached directly in the main window. There are no pull down menus.

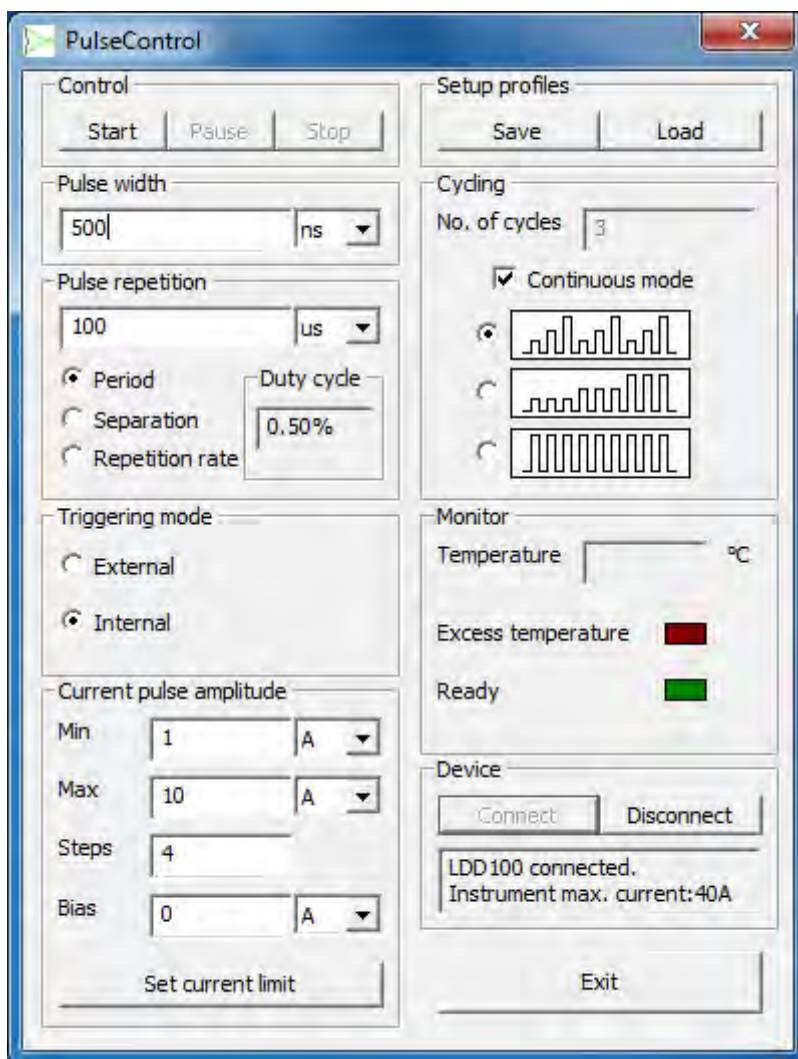


Figure 9: The Graphical User Interface (GUI)

10.1 Settings

The GUI is arranged in logical fields which are described in the sections below.

10.1.1 Field “Control”



Figure 10: Field “Control”

Start: Starts a sequence of current pulses.



DANGER!

The device under test will begin to emit potentially dangerous levels of laser power immediately after clicking the “Start” button. Ensure that all personnel are appropriately warned and wearing safety goggles.

Pause: Pauses the present running sequence. When pressed during a sequence, the “Stop” button on the front panel of the main unit will blink (red) until the sequence is continued (by clicking the “Start” button) or until the sequence is aborted (by clicking the “Stop” button).

Stop: Immediately stops the current driver and aborts the present running sequence.

10.1.2 Field “Pulse Width”



Figure 11: Field “Pulse Width”

Pulse width: Input an integer and select the units (ns, μ s, ms) from the dropdown box in order to set the width of the current pulses to be driven.

10.1.3 Field “Pulse Repetition”

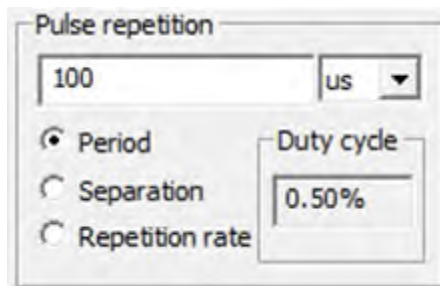


Figure 12: Field “Pulse Repetition”

- Pulse repetition: Input an integer and select the units (ns, μ s, ms) from the dropdown box in order to set the temporal value. The meaning of this value is determined by selection of one of the three radio buttons described below.
- Period: Radio button to select that the numerical input is to determine the period of the pulses of the current sequence.
- Separation: Radio button to select that the numerical input is to determine the separation of the pulses of the current sequence.
- Repetition rate: Radio button to select that the numerical input is to determine the repetition rate of the pulses of the current sequence.

10.1.4 Field “Triggering Mode”

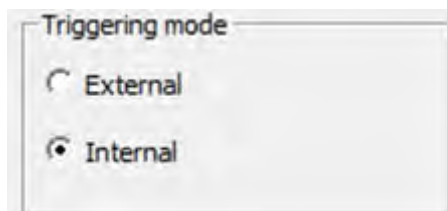


Figure 13: Field “Triggering Mode”

- External: The sequence as programmed through all of the other parameters is enabled by clicking the “Start” button on the GUI (Control section). However, the sequence will only start when the first rising edge into the “External Trigger” BNC-receptacle on the back panel of the main control unit is detected.
- Internal: The sequence as programmed through all of the other parameters is started by clicking the “Start” button on the GUI.

10.1.5 Field “Current Pulse Amplitude”

Current pulse amplitude

Min: 1 A

Max: 10 A

Steps: 4

Bias: 0 A

Set current limit

Figure 14: Field “Current Pulse Amplitude”

Min: Input an integer and select the units (mA, A) from the dropdown box in order to set the minimum current of the current pulse sequence to be driven. In pulse mode this is the constant current amplitude. In the case of an invalid input, the number entered will automatically be limited to the maximum allowed by the unit or the selected current limit (see below).

NOTICE!



Note that the current strength selected is critical!

The pulse current may be large enough to damage or destroy the laser.

Max: Input an integer and select the units (mA, A) from the dropdown box in order to set the maximum current of the current pulse sequence to be driven. This field is only active in serial or parallel sweep mode. In the case of an invalid input, the number entered will automatically be limited to the maximum allowed by the unit or the selected current limit (see below).

NOTICE!



Note that the current strength selected is critical!

The pulse current may be large enough to damage or destroy the laser.

Steps: Enter an integer number of steps. In serial or parallel sweep mode, the driver will sweep the current from “Min” to “Max” in an equidistant number of current steps.

Bias: Input an integer and select the units (mA, A) from the dropdown box in order to set the bias current. In the case of an invalid input, the number entered will automatically be limited to the maximum bias current allowed by the unit.

Set current limit: After clicking this button, a pop-up box will appear. Enter the limiting current for the present situation. This value must be less than or equal to the maximum current available for the system. This is a safety feature to allow the unit to be used to safely drive lasers which might otherwise be damaged by currents at the maximum drive capability of the unit.

10.1.6 Field “Setup Profiles”

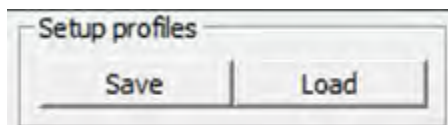


Figure 15: Field “Setup Profiles”

Since the sequence involves setting up many parameters which may have potentially damaging effects on the laser under test, there is a provision for storing setup files. These files can be appropriately named and contain all of the parameters. This is useful when testing different types of devices.

Save: Saves a setup file.

Load: Loads a setup file which overwrites all of the settings on the GUI panel.

10.1.7 Field “Cycling”

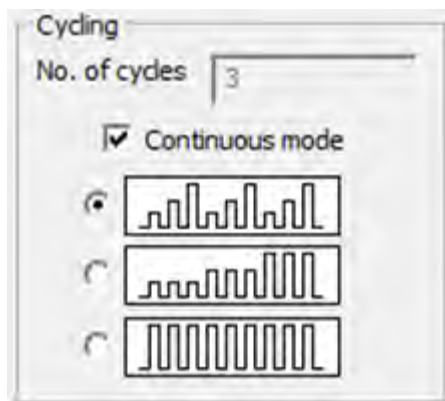


Figure 16: Field “Cycling”

No. of cycles: Enter an integer to determine the number of cycles of the sequence which will be run. The unit will stop operation after completion of the number of cycles if the “Continuous mode” radio button is activated.

Continuous mode: Radio button to determine the action of the system after completion of a sweep. If the radio button is not active, the system will stop operation after completion of one sequence with the number of cycles entered in the field “Number of cycles”. If the radio button is active, the unit will repeat the sequence an indefinite number of times until the “Stop” button is clicked.



Radio button to activate the serial sweep mode. This mode performs a current sweep by stepping the pulse current from the minimum set value to the maximum set value in a number of equidistant currents as determined by the parameter “Steps”. More than one cycle may be run automatically via the parameter “Number of Cycles”. Each sweep is run from the minimum to the maximum current before the next cycle begins.



Radio button to activate the parallel sweep mode. This mode performs a current sweep by stepping the pulse current from the minimum set value to the maximum set value in a number of equidistant currents as determined by the parameter “Steps”. More than one cycle may be run automatically via the parameter “Number of Cycles”. Each current of the sweep is pulsed “Number of Cycles” times before the next current is set.



Radio button to activate the pulse mode. The pulse mode is used to pulse the driver at constant current with a single pulse width and pulse separation during the whole sequence.

10.1.8 Field “Monitor”

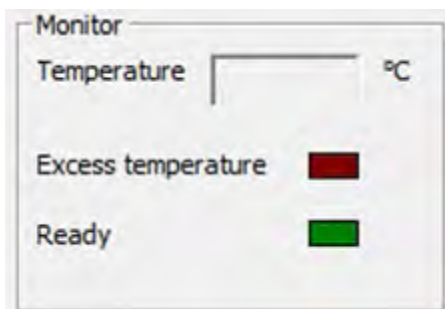


Figure 17: Field “Monitor”

Temperature: The temperature of the end stage is measured at the end of each sequence and indicated in this non-editable field.

Excess temperature: If the temperature of the end stage exceeds the maximum allowed temperature, the end stage will shut down to prevent damage and the status will be indicated by lighting this red virtual LED. Wait until the end stage has cooled down (10 minutes) and then restart the system. The parameter settings will need to be changed in order to prevent the excess temperature state from reoccurring. An excess temperature state is very unlikely unless the end stage head is in a hot ambient environment or convection cooling of the head is prevented in some manner.



NOTICE!

Do not place the end stage unit in a vacuum or prevent convection cooling!

The end stage head is convection cooled and as such must be in a free flowing air environment.

Ready: This green virtual LED is lit when the system is functionally operable.

10.1.9 Field “Device”

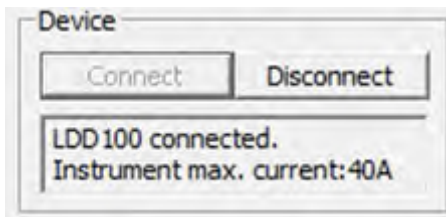


Figure 18: Field “Device”

Connect: When the system is first turned on and the GUI is started, the (real) touchpad front panel is the active control input panel. In order to transfer control to the GUI, the software must connect to the system. This action is performed by clicking the “Connect” button.

Disconnect: When connected, clicking the “Disconnect” button will revert control to the (real) touchpad front panel of the main control unit. This does not close the GUI frame.



NOTICE!

Note that the parameters will not be the same as those last used in the GUI!

When switching from GUI control to real front panel control, the parameter set is defaulted to the last parameter set used in front panel control. Check the settings before running the system, as they might be very different and lead to damage of the device under test!

Information field: Indicates the device connected as well as the maximum current that the driver can deliver.

10.1.10 Field “Exit”

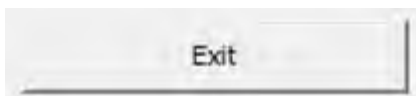


Figure 19: Field “Exit”

Exit: Exits the software thus closing the GUI frame and reverting control to the (real) touchpad front panel.



NOTICE!

Note that the parameters will not be the same as those last used in the GUI!

When switching from GUI control to real front panel control, the parameter set is defaulted to the last parameter set used in front panel control. Check the settings before running the system, as they might be very different and lead to damage of the device under test!

11 Communication

Communication with the LDD100 is via USB 2.0.

The most recent USB driver for the Microsoft Windows[®] operating system is included on the storage medium shipped with the device.

Following installation there will be two drivers in the device manager under “System Properties”. One is in the communication ports (COM und LPT), the other is in the list of USB controllers.

The first driver generates a virtual COM port for ease of control. The communication can be realized via a terminal programme.

The second driver can be addressed directly without a port number for integration in custom software. A library file (dll-file) and example programmes showing use of the dll are also included on the storage medium provided (folder “SDK”). The description of the dll-file is contained in a separate document.

11.1 Connection

The following paragraphs describe the direct communication with the LDD100 in the same manner as used in the dll-file.

After opening the connection, the following procedure must be followed:

1. Send a Byte with the value 170 (decimal) or AA (hex).
2. Wait 100ms.
3. Set RTS.
4. Wait 100ms.
5. Check whether CTS is set. If not, then the connection was not successful.
6. Read one Byte. This Byte is the instrument code and must be 16 (decimal) or 10 (hexadecimal).
7. Read one Byte. This is the firmware version. The Byte 30 (decimal) stands for Version 3.0 and must correspond to the software being used.
8. Read one Byte. This Byte is the current limit high Byte (HB).
9. Read one Byte. This Byte is the current limit low Byte (LB).

The current limit is calculated as $((HB*256) + LB)*10$ [A].

10. Read one Byte. This Byte is the maximum current of the instrument, high Byte (HB).
11. Read one Byte. This Byte is the maximum current of the instrument, low Byte (LB).

The maximum current of the instrument is calculated as $((HB*256) + LB)*10$ [A].

12. Read one Byte. This Byte is the maximum bias current of the instrument, high Byte (HB).
13. Read one Byte. This Byte is the maximum bias current of the instrument, low Byte (LB).

The maximum bias current of the instrument is calculated as $((HB*256) + LB)*10$ [A].

14. Read one Byte. This is a status Byte. If no errors have occurred, the value will be 0.

Thereafter, the RTS line must be switched with a period of approximately 200ms, independent of all other communication. Delay of this switching will result in abortion of the communication connection.

11.2 Parameter Upload

The parameter set has to be uploaded before any current pulse may be generated.

In the upload process all data is send byte by byte. After receiving one byte the device returns the received byte (echo). Following verification, the next byte can be send. An error in data transfer can be realized in this manner.

Note that all data must be uploaded in the order described, even if not all parameters are used in an operating mode. The general data upload starts with “@P”.

Table 15: Upload Parameters

Byte No.	Description	Range	Meaning / Conversion
1	Pulse repetition (High Byte) ²¹	1-10,000	10µs – 100ms
2	Pulse repetition (Low Byte)		100µs-1s 1ms-10s
3	Pulse Width (High Byte) ²²	1 – 40,000	50ns – 3s
4	Pulse Width (Low Byte)		
5	Minimum Current (High Byte) ²³	0 – 4,095	0-200A (48,8mA/bit)
6	Minimum Current (Low Byte)		
7	Maximum Current (High Byte) ²³	0 – 4,095	0-200A (48,8mA/bit)
8	Maximum Current (Low Byte)		
9	Current Steps (High Byte)	1 – 1,000	
10	Current Steps (Low Byte)		
11	Bias (Low Byte)	0 – 4,095	0-1A (0,244mA/bit)
12	Bias (High Byte)		
13	Number of cycles (MSB Byte)	1 - 1,000,000,000	
14	Number of cycles (middle Byte)		
15	Number of cycles (middle Byte)		
16	Number of cycles (LSB Byte)		
17	Cycling Mode	0 – 2	0: parallel 1: serial 2: Burstmode

²¹ The repetition range depends on clock parameter.

²² The pulse width depends on this parameter and clock parameter as well (s. section: clock parameters).

²³ 200A is just an example. The real value depends on the LDD type.

18	Continuous Mode	0 - 1	0: Not Continuously 1: Continuously
19	Pulse Width Timer	0 – 250	0 – 150µs (600ns steps)
20	Pulse Separation Timer (High Byte)	200 - 20 000	10µs – 1ms range multiplier for pulse separation
21	Pulse Separation Timer (Low Byte)		

Following upload of the parameter set, the instrument performs an internal test of the validity of the input values. If the parameter set is valid, the Byte 0 is returned (no errors). If any errors have occurred, the Byte 13 is returned followed by the error code.

Table 16: Error Codes

Error Code	Meaning
10	Period: value too low (<1)
11	Period: value too high (>10,000)
12	Pulse duration: value too low (<1)
13	Pulse duration: value too high (>40,000)
14	Minimum current: value too high (> 4,095)
15	Maximum current: value too high (> 4,095)
16	Number of steps: value too low (<1)
17	Number of steps: value too high (> 1,000)
18	Bias: value too high (> 4,095)
19	Number of cycles: value too high (> 1,000,000,000)
20	Number of cycles: value too low (<1)
21	Mode: value too high (>2)
22	Continuous mode: value too high (>1)
23	Pulse separation timer: value too high (> 250)
24	Pulse separation timer: value too low (< 200)
25	Pulse separation timer: value too high (> 20,000)
50	The minimum current is lower than the bias current
51	The maximum current is lower than the bias current
52	Safe operating area: the duty cycle is too high
53	Safe Operating Area: the pulse duration is too high for the maximum. current
54	The minimum current is higher than the maximum current
55	The repetition period must be at least 9µs

The parameter upload may visualized by the following flow chart:

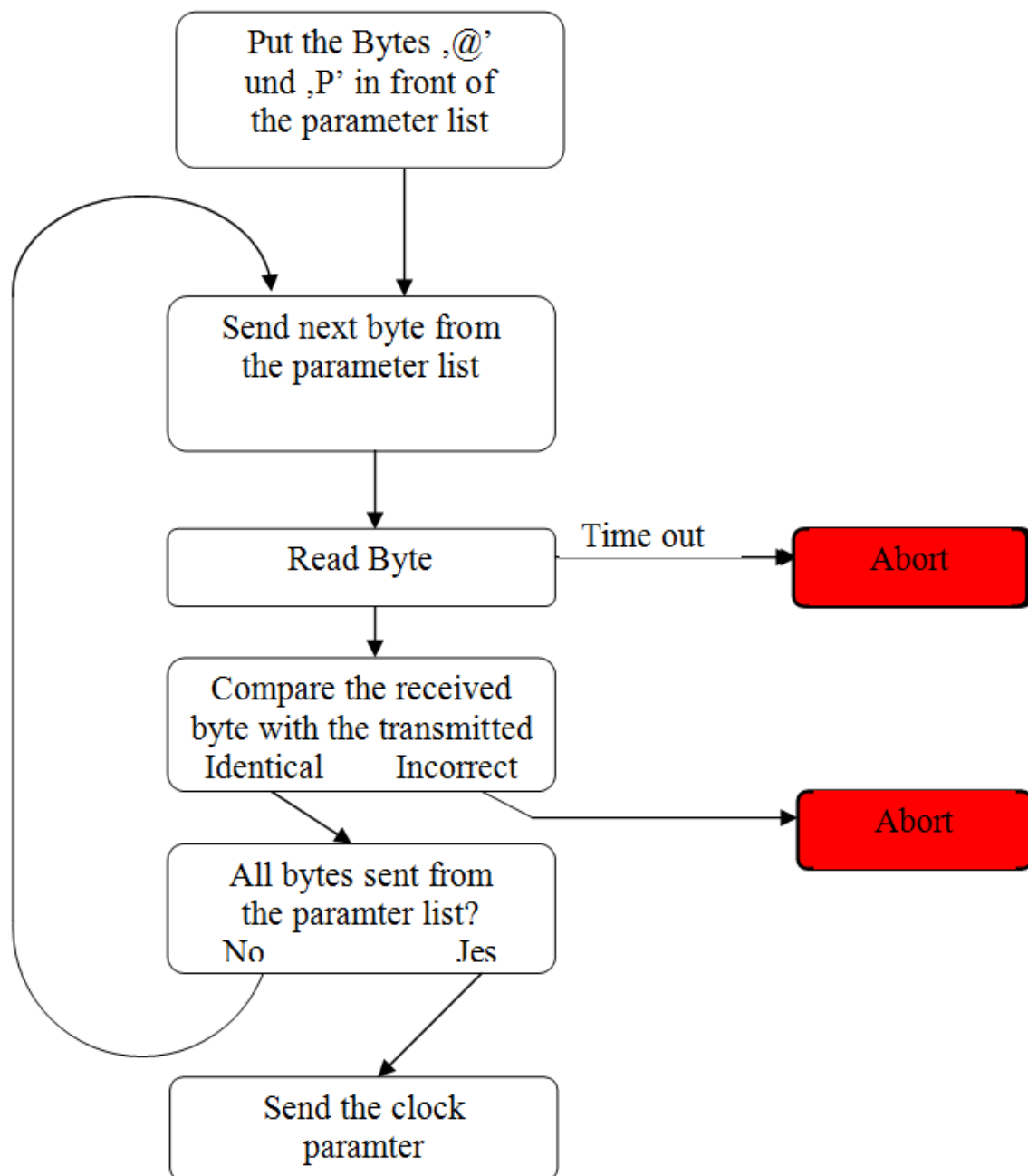


Figure 20: Schematic Representation of the Parameter Upload

11.2.1 Pulse Duration

As for the pulse repetition period, the pulse duration is calculated via a base parameter (Byte 3 and Byte 4) as well as a timer (Pulse Width Timer (PWT): Byte 19). If the PWT is set to 0, the base parameter has a value of 50ns. Thus, for pulse durations up to 2ms, the PWT may be set to 0 ($50\text{ns} \times 40,000 = 2\text{ms}$).

For longer pulse durations, the PWT must be set >0 and increments in a resolution of 600ns. The following algorithm may be used to calculate the pulse width:

1. For $\text{PWT}=0$: pulse duration = $((\text{width-HB} \times 256) + \text{width-LB}) \times 50\text{ns}$
2. For $\text{PWT} \geq 1$: pulse duration = $((\text{width-HB} \times 256) + \text{width-LB}) \times \text{PWT} \times 600\text{ns}$

Example:

Byte 3 = 10

Byte 4 = 2

Byte 19 = 20

Pulse duration = $((10 \times 256) + 2) \times 20 \times 600\text{ns} = 30,744,000\text{ns} = 30.744\text{ms}$.

11.2.2 Pulse Repetition Period

The pulse repetition period = pulse duration + pulse separation.

The calculation requires the value of the pulse repetition parameter (Byte 1 and Byte 2) as well as the pulse separation timer (PST) (Byte 20 and Byte 21).

The calculation of the pulse duration has been discussed in the previous subsection. For the pulse separation, the base period is multiplied by the PST which has a minimum value of 200 leading to a minimum pulse separation of $50\text{ns} \times 200 = 10\mu\text{s}$.

The pulse repetition period is therefore calculated as follows:

Period = (pulse duration) + (pulse repetition \times PST)

Example:

Byte 1 = 6

Byte 2 = 5

Byte 3 = 10

Byte 4 = 2

Byte 19 = 20

Byte 20 = 4

Byte 21 = 6

Pulse duration = $((10 \times 256) + 2) \times 20 \times 600\text{ns} = 30,744,000\text{ns} = 30.744\text{ms}$.

Pulse separation = $((6 \times 256) + 5) \times ((4 \times 256) + 6) \times 50\text{ns} = 79,361,500\text{ns} = 79.3615\text{ms}$

Period = $30.744\text{ms} + 79.3615\text{ms} = 110.1055\text{ms}$

11.2.3 Current Steps

The number of equidistant steps when sweeping from the minimum to the maximum current. This is calculated as follows:

Number of steps = (Byte 9 x 256) + Byte 10.

11.2.4 Bias

This parameter sets the bias current. This value is limited to 1A and may be set with a resolution of $4095 = 0.244\text{mA/bit}$. The set value is calculated as follows:

Bias current = ((Byte 11 x 256) + Byte 12) x 1A / 4095

11.2.5 Number of cycles




This parameter sets the number of cycles to be repeated in a sequence. In pulse mode this is the number of pulses. In sweep modes, this is the number of repetitions of each current during the sweep.

The set value is calculated as follows:

No. of cycles = (Byte 13 x 256^3) + (Byte 14 x 256^2) + (Byte 15 x 256) + Byte 16

11.2.6 Cycling mode

This parameter sets the mode of operation as follows:

- 0: parallel sweep 
- 1: serial sweep 
- 2: pulse mode 

11.2.7 Continuous Mode

If the continuous mode is not active, the system will stop operation after completion of one sequence with the number of cycles entered in the field "Number of cycles". If the continuous mode is active, the unit will repeat the sequence an indefinite number of times until the "Stop" button is clicked.

The mode can be selected as follows:

- 0: not continuous mode
- 1: continuous mode activated

11.2.8 Starting a sequence

The laser driver is started by using a command for the trigger selection. Three trigger selections are possible.

@S – starts the driver immediately. It uses an internal trigger.

If Byte 33 “!” is returned, then the uploaded parameter set is not valid.

@e – start a sequence with external Trigger. When the trigger signal rises, the full sequence is generated.

If Byte 33 “!” is returned, then the uploaded parameter set is not valid.

@E - start a single pulse of a sequence. When the trigger signal rises only one pulse of the sequence is generated. To complete the sequence a signal for every pulse must be applied.



NOTICE!

Use of this function requires special care in order to not damage the instrument!

Setting the @E command at a repetition rate higher than allowed by the safe operating area can damage the instrument. See 5.1.1 "Safe Operating Area (LDD100-F040)" pg. 25 and 5.2.1 "Safe Operating Area (LDD100-F120)" pg. 27 for details.

11.2.9 Stop a sequence

When sending an escape (Byte 27) the driver stops immediately. It quits by sending two bytes. The first one is the current modulator flag. The second is the internal measured temperature of the laser driver in °C.

Byte 1 – Bit 0 to Bit 7:

Bit 2: Driver is ready

Bit 3: Excess temperature

11.2.10 Read status and temperature of the laser driver

By sending @R to the driver two bytes will be returned. These indicate the current modulator flags (first byte) and the internal measured temperature (second byte).

See: Stop a sequence.

11.3 The SDK Package

The LDD100 comes with a software development kit (SDK package) in order to ease integration of the instrument into OEM projects.

This package includes the source code of the application programme (written in Microsoft VB.net version 2005) as well as a LabVIEW[®] VI example.

The projects in this folder are all based on the integration of the library file LDD100_COM.dll in different programming languages (VB.net and LabView).

The SDK package is found on the storage media delivered with the instrument.

11.4 Source Code of the Application Programme

The project file LDD100_dll.sln is stored on the storage media delivered with the instrument. This file contains all of the necessary window files, modules, graph and icon files as well as the necessary compiling settings. This file may be loaded into the software development environment.

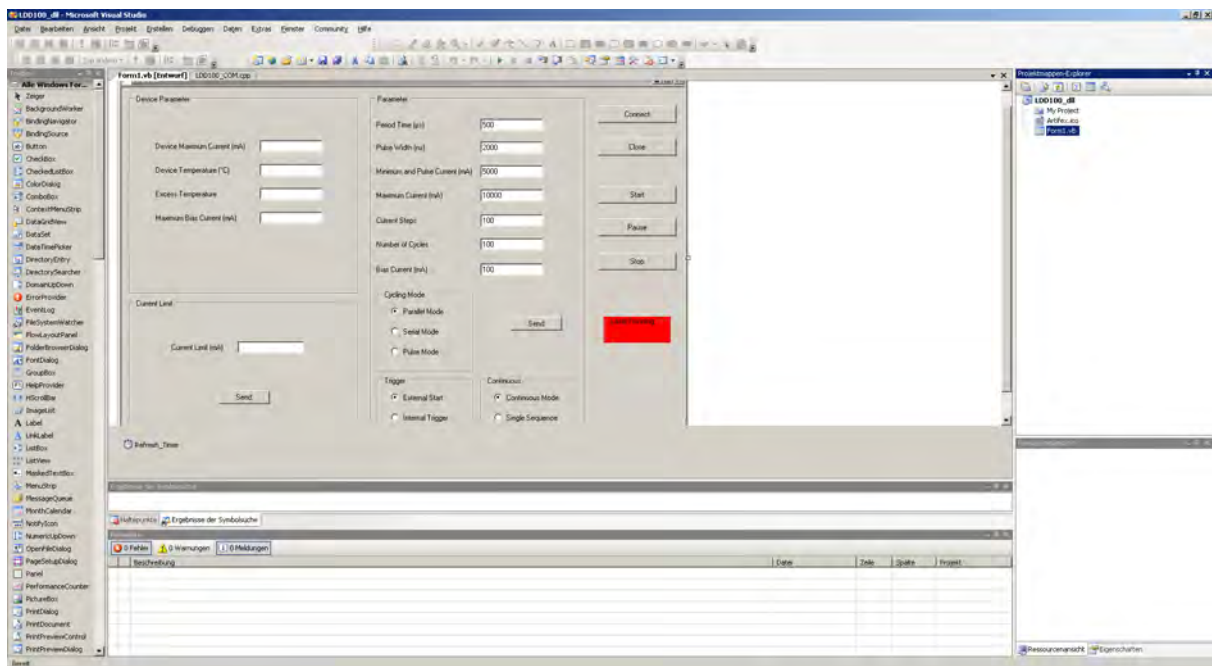


Figure 21: Software Development Kit (SDK) for VB.net

All enclosed files are shown in the project explorer (lower left window). The folder structure is the same as is found on the storage media delivered with the instrument.

The graph in the main window is generated by embedding the file Graph.dll in the output. For more information, see Hinweis.txt.

Further details are contained in the comments in the source code.

[®] „LabVIEW“ is a registered trade mark of the National Instruments Corporation.

11.5 Documentation for LabVIEW® LDD100Com.vi

The LDD100 is delivered with a fully functional demo virtual instrument (VI). In order to implement the LDD100 within a larger LabView programme framework, it is recommended to use the supplied VI as the starting point. The main programme comprises the Demo.vi (graphical user interface), further VIs are included for controlling the LDD100. The software drivers must be installed prior to use of the Demo.vi.

In order to communicate with the LDD100, a connection with the PC must occur. This is handled by the LDD100_COM.dll. All of the VIs use the functions of this dll-file. The parameters are described in detail in the separate document describing the LDD100_COM.dll.

In order to control the LDD100, various sub-VIs are provided. Their individual function is described in their respective file names. Thus GetMaximumCurrent.vi reads out the maximum current of the instrument.

Some VIs have an input and an output value for the same parameter. In these cases, the upload values are checked within the function and corrected as required. For example, if the uploaded current value is not valid, it will be automatically corrected to the nearest valid value. The result can be checked via the output value (see SetParameter.vi).

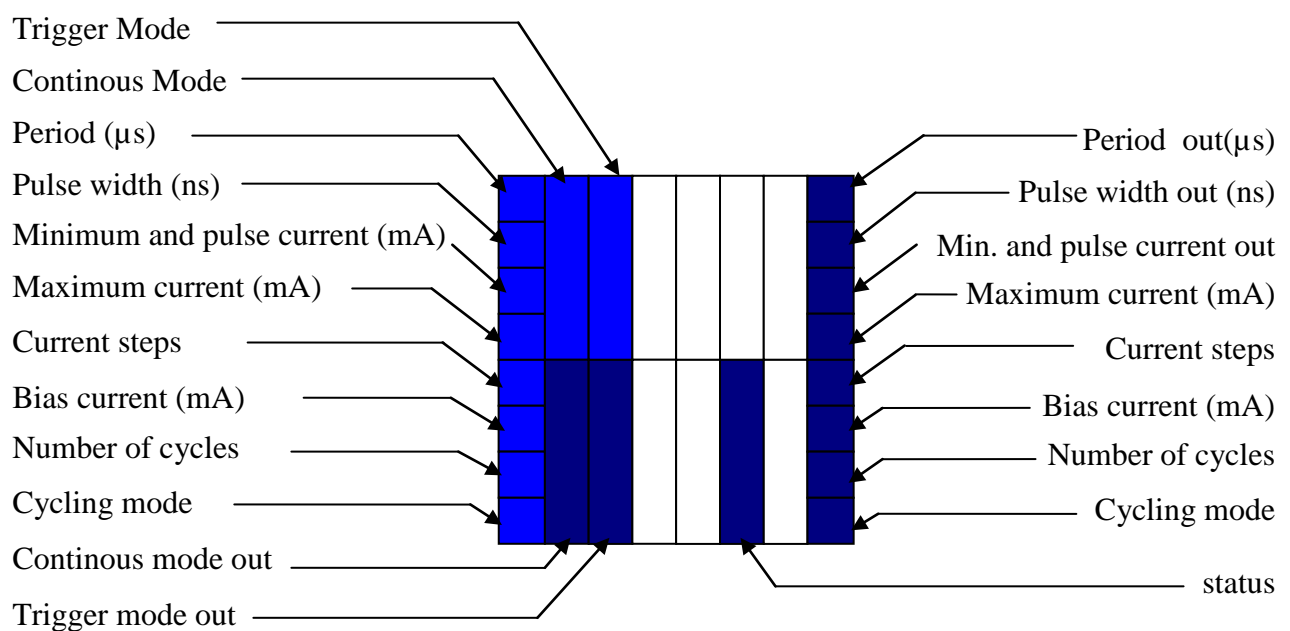


Figure 22: Connection Diagramme for the SetParameter.vi

All parameters and their details are described in detail in 11.2 “Parameter Upload”, pp63.

12 Disposal

Do not dispose of the laser diode driver with the household waste. The worn out unit can be taken to an electronics and metal recycling centre for disposal. The manufacturer also accepts old units for disposal.



NOTICE!

Danger for the environment from improper disposal!

Dangers for the environment can arise through improper disposal.

- Never dispose of the electronic ballast with the household waste.
- Take the electrical scrap or electronic components to an approved specialist company for disposal.
- In case of doubt, contact the local authorities or a special disposal company for information about the environmentally compatible disposal.



13 Type plate

The type plate is located on the back of the enclosure and includes the following information:

- Manufacturer
- Model number
- Article number
- Serial number
- Date of manufacture (mm/yy)



14 Notice

Artifex Engineering reserves the right to make changes to its products or to discontinue any product or service without notice and advises customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement and limitation of liability.

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Artifex Engineering does not approve use of this product in medical instrumentation or applications.



DANGER! The LDD100 series of laser diode drivers is designed for use with lasers. Personnel who use this instrument must, therefore, be instructed in the safe use of lasers and laser beams.

Always wear the proper laser safety glasses designed for the laser in use!

Never allow the direct or reflected laser beam to impinge on the eyeball or to come into contact with the skin!

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