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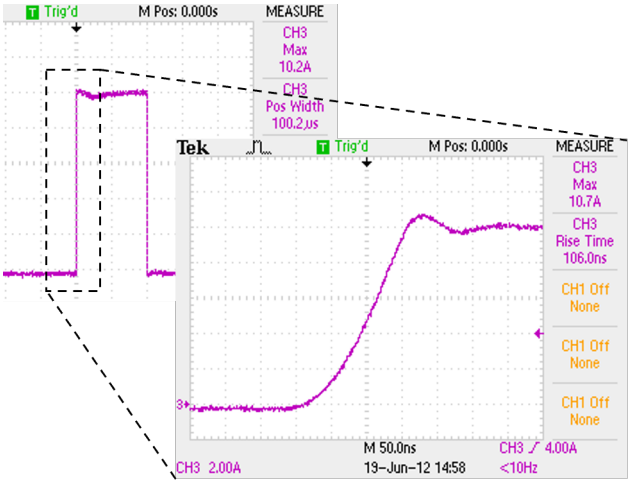
LDD-1121

Hardware Version v1.60

The LDD-1121 is a current driver designed to precision-drive laser diodes or other loads in continuous / modulated and pulsed or mixed operation. Featuring fully digital current and optional light power control, various safety features and comprehensive communication interfaces, it offers a complete solution for continuous or pulsed applications. The device communicates through various interfaces, provides an API for system integration and comes with a comprehensive GUI software for seamless operation.

HIGHLIGHTS

- **Input Voltage:** 12 – 24 VDC
- **Laser Diode Driver:**
  - Output Voltage: 0 – 15 V
  - Output Current: 0 – 15 A
  - Pulse Generation: CW Chopping, up to 80 kHz
  - Pulse Rise Time: 110 ns ($L_{Load} \approx 15$ nH)
  - Efficiency: > 92 % (@ > 50 % Load)
  - Ultra-Fast Switch-off for optimal LD protection
  - 333 ps PWM timing steps for high resolution (0.3 mA) and very low ripple current (< 0.1 %)
  - Temperature Coefficient: 15 ppm/K
- Dimensions: 120 × 90 × 18 mm
- Digital PID-controlled current source with internal signal generator and LUT
- Safety features: Hardware enable input and overvoltage/ -current/ -temperature protection
- Easy configuration and graphical data acquisistion via provided GUI software
- Stand-alone or remote-controlled operation via USB (isolated) and 2 × RS485 / RS422
- GPIO features for monitoring and control (Enable, Pulse, Trigger, Error Indication, etc.)
- Optional -LPC version allows for precise controlling of Light Power through Photodiode feedback



Trial Device & Technical Support

Trial devices and technical support are available for evaluation projects.
Please contact support@meerstetter.ch or visit our support center.

RELATED PRODUCTS

Model	Output Range	Modes	Description
LDD-1301	0–20 A / 0.5–45 V	1 ms – CW	higher voltage
LDD-1303	0–20 A / 1–120 V	1 ms – CW	higher voltage
LDD-1321	0–1.5 A / 0–14 V	CW, Add-on TEC Controller available	more compact, lower power
LDD-1137	0–75 A / 0–70 V	1 ms – CW, modulated, QCW and pulsed modes	higher power

See the full product overview in the Meerstetter Engineering's Product Compatibility section.

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1 SPECIFICATIONS

1.1 Absolute Maximum Ratings [1]

		Min	Max	Unit
Voltage	$U_{IN, DC}$		27	V
	U_{OUT}		U_{IN}	V
Current	I_{IN} (On Board Fuse)		12	A
	I_{OUT}		18.5	A

1 Operation at or beyond the absolute maximum ratings may result in permanent device damage. These limits are stress ratings only and functional operation of the device at these conditions is not guaranteed. Prolonged exposure to absolute maximum conditions can adversely affect long-term reliability and should be avoided during normal operation.

1.2 Operating Characteristics

		Min	Max	Unit
Temperature	Operation Temperature	0	60	°C
	System Base Plate		50	°C
	Storage	–30	70	°C
Humidity	RH_{OP}, non-condensing	5	95	%

1.3 Electrical Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 24 V, U_{LD} = 10 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
DC Power Supply Input:						
U_{IN}	Supply voltage		11.5	24	26.5	V
U_{IN_RIPPLE}	Ripple tolerance				300	mV_{PP}
System Characteristics:						
$\eta_{50\%}$	Power efficiency	@ 50% load		92		%
$\eta_{90\%}$	Power efficiency	@ 90% load		95		%

1.4 Laser Output Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 24 V, U_{LD} = 10 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Output CW:						
I_{OUT}	Current range		0		15	A
$T_{coefficient}$	Temp. coefficient	I_{out} = 15 A, T_A = 25 – 50 °C		15	35	ppm/K
I_{OUT_RES}	Current resolution			0.3		mA
I_{OUT_RIPPLE}	Current ripple	I_{out} > 1A		3	20	mA
U_{OUT_MAX}	Diode voltage		0		15	V
U_{OUT_LIMIT}	Output voltage			U_{IN} – 8		V
P_{OUT}	Output power	U_{LD} = 15 V			225	W
f_{CW}	Current change	For L_{Load} < 100 nH, higher f_{CW} are possible		3		kHz
I_{OUT_SLOPE}	Current slope limit	Iout > 5A		0.1		A/µs
Output Pulse:						
t_{rise}	Current rise time	L_{Load} ≈ 15 nH, U_{LD} = 8.5 V		110		ns
t_{fall}	Current fall time	L_{Load} ≈ 15 nH, U_{LD} = 8.5 V		110		ns
t_{delay}	Delay pulse/current	L_{Load} ≈ 15 nH, U_{LD} = 8.5 V		800		ns
t_{pH_min}	Minimal Pulse High	L_{Load} ≈ 15 nH, U_{LD} = 8.5 V		0.5		µs
t_{pL_min}	Minimal Pulse Low	L_{Load} ≈ 15 nH, U_{LD} = 8.5 V		1		µs

1.5 Safety Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 24 V, U_{LD} = 10 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
I/O Ports:						
$t_{OFF\_CURRENT}$	Overcurrent			6	8	µs
t_{OFF_OPVAL}	Operating Values	Voltages, currents		100		ms
t_{OFF_SFAIL}	System failure	System status		100		ms

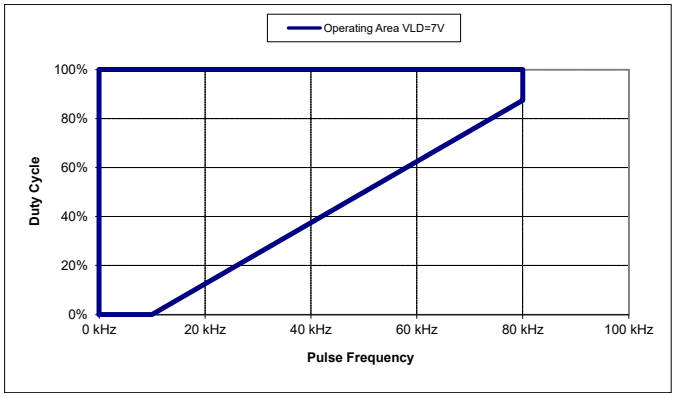
1.6 Pulse Operation

In pulse operation mode, it is important that the load inductance is as low as possible. It should be well within the low nH range. As a rough rule, every millimeter of cable adds around one nH of inductance.

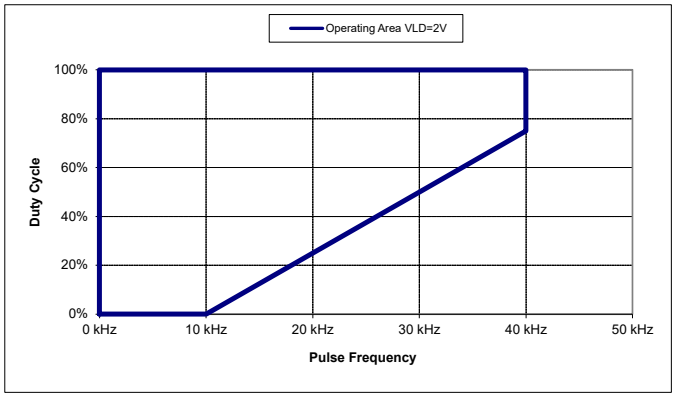
For optimal performance, the following Parameters should be met:

- **L_{LOAD} as low as possible**
- **$U_{OUT} < 0.5 \times U_{IN}$**

Following two figures show the approximate operating combinations between pulse on/off-time (duty cycle) and repetition rate (frequency). The operating point for these two tests was set to 7.37 V and 2.26 V on the laser terminal respectively.



Test Conditions:
T_A = 25 °C, U_{IN} = 24 V, I_{LD} = 10 A
U_{LD} = 7.36 V @ 10 A, R_{LD_Diff} = 350 mΩ, L_{LD} = 18 nH
Laser diode directly mounted to the screw terminals.



Test Conditions:
T_A = 25 °C, U_{IN} = 24 V, I_{LD} = 10 A
U_{LD} = 2.26 V @ 10 A, R_{LD_Diff} = 100 mΩ, L_{LD} = 15 nH
Laser diode directly mounted to the screw terminals.

The maximum achievable pulse frequency depends on the connected load's characteristics. The reason for the performance derating for high frequencies and low duty-cycles (bottom-right part of the operating area) are the internal control topology and available FPGA hardware resource.

If your operating point is just outside the operating range and/or your test conditions are different, please contact us at support@meerstetter.ch for more detailed information or requesting a trial device.

1.7 Laser Diode Temperature Measurement

Unless otherwise noted: T_A = 25 °C, U_{IN} = 24 V, NTC = $B_{25/100}$ 3988K R_{25} 10k

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Temperature Measurement:						
R_{NTC}	NTC Resistance			10		kΩ
T_{RANGE}	Temperature Range		–6		150	°C
$T_{PRECISION}$	Temp. Precision	Not calibrated			1.5	°C

1.8 Light Measurement Characteristics [Devices with -LPC Option only]

Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V, U_{BIAS} = –3.3 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Photodiode Input Characteristics:						
I_{PD}	Photodiode current				4	mA
f_{ADC_LPC}	Sampling frequency	@ 16bit		0.5		MSPS

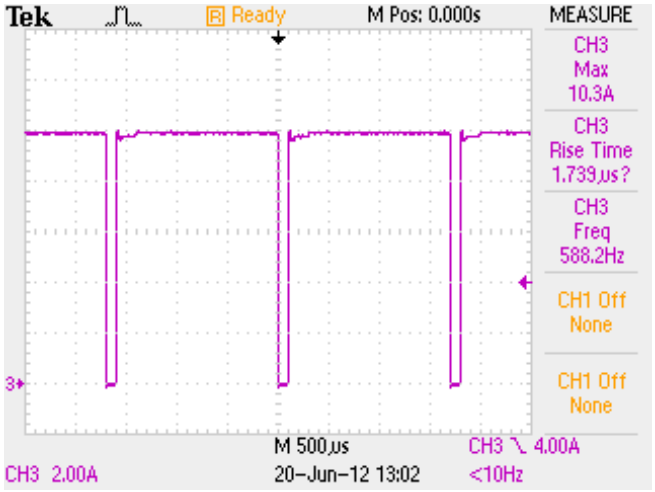
2 FUNCTIONAL DESCRIPTION

2.1 Current Controlled Operation Modes and Communication Options

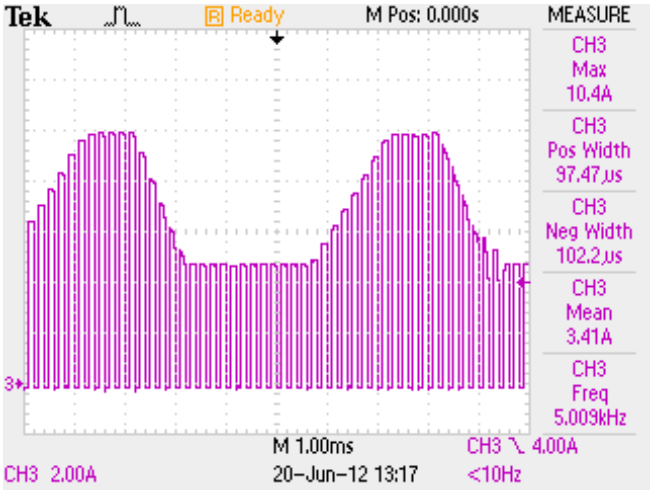
The LDD-1121 is an OEM high performance current source that is primarily designed to operate as a fast pulsed laser diode driver but that can also be used in CW mode. It is configured over an industry-standard RS485 or a USB connection, either GUI-driven using the included Service Software, or by direct parameter control using the predefined communication protocol. Basic system status is visually indicated by on-board LEDs, more detailed status information can be polled at any time. The LDD-1121 can operate in a stand-alone configuration as well as in a remotely-controlled manner, with parameters adjusted on the fly. The laser diode driver is current-PID-controlled.

Configuration parameters further include: control source selection, maximum current limits, nominal current ramping, PID controller settings, NTC temperature sensor modeling coefficients, measurement circuitry calibration, error thresholds, communication watchdog, etc. Please refer to the user manual for further information.

2.2 Typical Current Waveforms



High duty-cycle chopping, unmodulated CW.



High repetition rate chopping, modulated CW.

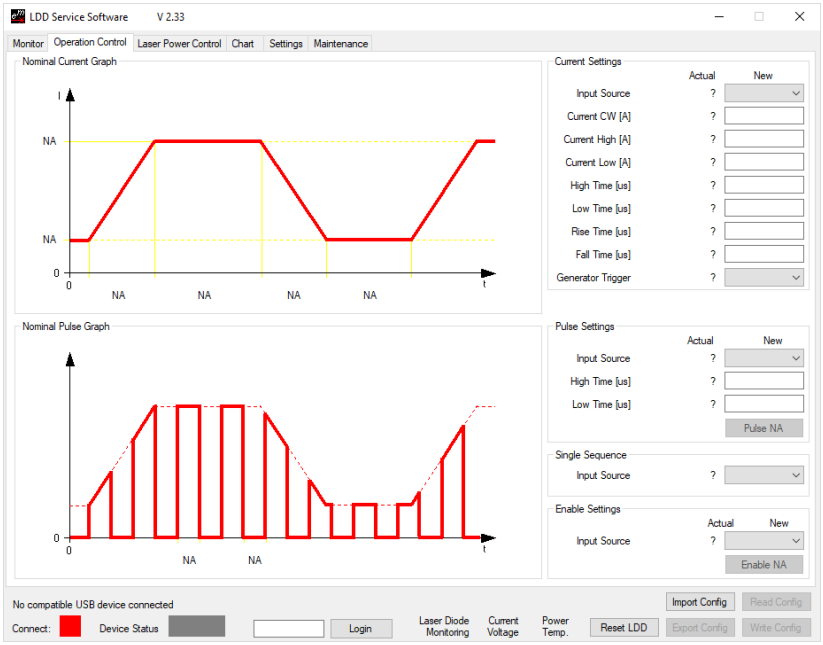
2.3 Service Software

The included Service Software is a powerful tool that allows monitoring and full configuration of the LDD-1121 via a standard USB or an RS485 connection from a PC running Windows.

This tool is ideal for laboratory setups, product evaluation diagnosis, debugging and commissioning:

- internal generators set up (see Figure below)
- configuration import and export
- data charting with trigger functionality
- error codes and built-in descriptions
- hardware configuration (e.g. calibration)
- maintenance (e.g. firmware upgrades)

Please refer to the laser diode driver user manual for more information on features and system requirements.

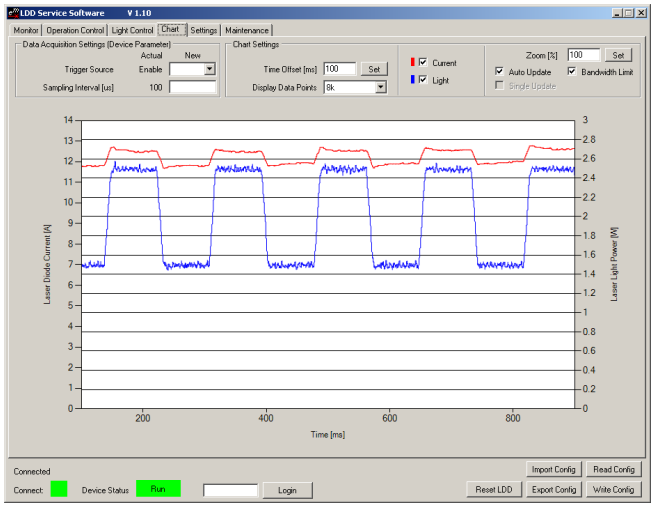


CW Current Modulation and Chopping by Internal Generators.

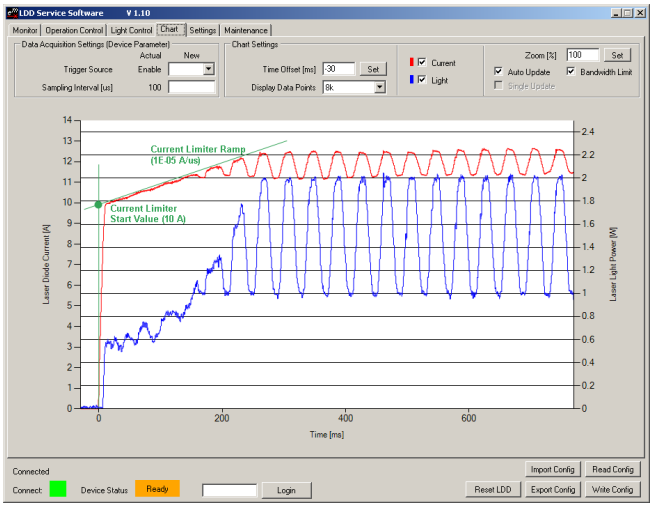
2.4 Light-Power-Controlled Operation Mode [Devices with -LPC Option only]

The LDD-1121-LPC is a laser power controller that is based on the LDD-1121, with additional light measurement circuitry (photodiode input). A user-defined “Light System Scale“ factor links the generated photocurrent to the absolute light power. The light PID controller’s output is fed to the current controllers input. The nominal light power value may be CW, modulated CW (using internal generation) or remotely controlled. A configurable soft-start feature is available, as well.

2.5 Typical LPC Waveforms



Laser Power Control (blue) and Diode Current (red).



LPC Soft-Start Limitation (green).

3 INTERFACE AND CONNECTORS

3.1 General Purpose Digital I/O Characteristics on X3 (RES1 ... RES8)

Unless otherwise noted: T_A = 25°C, U_{IN} = 24 V

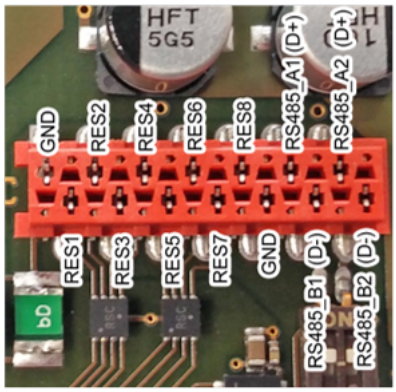
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Input Characteristics:						
U_{IH}	Logic high input threshold		2.35			V
U_{IL}	Logic low input threshold				0.9	V
U_{IMAX}	Maximum input voltage		–0.3		5.5	V
U_{AN}	Input voltage range	Analog input	0		3	V
Output Characteristics: (RES1 ... RES4)						
U_{OH}	Logic high output voltage		2.9	3.3		V
U_{OL}	Logic low output voltage			0	0.4	V
R_S	Series Resistor		170	200	230	Ω
Output Characteristics: (RES5 ... RES8)						
VOH	Logic high output voltage		2.9	3.3		V
VOL	Logic low output voltage			0	0.4	V
RS	Series Resistor		1160	1200	1240	Ω
ESD Protection:						
U_{PP}	ESD discharge	IEC61000-4-2			100	kV

3.2 Package Outline and Pin Configuration

Mounting (M3-size Bores, 7.5mm in Length):
M1: x = 4.0 mm, y = 86.0 mm
M2: x = 98.0 mm, y = 86.0 mm
M3: x = 4.0 mm, y = 4.0 mm
M4: x = 98.0 mm, y = 4.0 mm

Power Terminals: M4-size Screws

Pin Descriptions Plattform Bus X3:
TE Connectivity PLUG 14-POL: 8-215083-4



Laser diode, temperature probes, power supply and connectors not included.

4 ORDERING AND CONFIGURATION

4.1 LDD-1121 Ordering Information & Configuration

Example Configuration:
LDD-1121 (NA) FW2.33

Variant Name	Requirement	Description	Options / Single choice
Photodiode Input	**Required**	**Select the presence of the photodiode input and the associated laser power control feature. Default: maximum measurable photocurrent 4mA, reverse bias voltage 0V. Options (0.5mA/1mA/2mA/4mA and 0V/3.3V/8.5V) can be specified in the customer specific modifications.**	**NA, LPC**
Firmware Version	Optional	Select a compatible firmware if you do not want the latest version (default). Check the relevant Software Release Notes for details.	Example: FW2.33
Customer Specific Modifications	Advanced	Usually hardware modifications, available only on demand and quote.	Empty, or example: CS3
Customer Specific Profile	Advanced	Preset parameters/configuration, available only on demand and quote.	Empty, or example: 15
Hardware Version	-	For reference, specifies the hardware version (latest by default, subject to future change).	Example: HW1.60

Further customization can include digital lines for control, diagnosis and communication protocols. Please contact Meerstetter Engineering GmbH with your inquiry.

4.2 Ordering Confirmation Example

LDD-1121 (NA, HW1.60)
Firmware Version: FW2.33

String can additionally contain:
Profile: Default

5 ALL MEERSTETTER ENGINEERING PRODUCTS

5.1 Meerstetter Engineering's Product Compatibility

The Laser Diode Drivers and TEC Controllers from Meerstetter have been developed to work along with each other. They share the same platform bus, communication protocol and hardware architecture. See the following table for an overview of the Laser Diode Drivers and TEC Controllers from Meerstetter Engineering:

Model		Output	Description
Laser Diode Drivers			
LDD-1321		0–1.5 A / 0–14 V	CW, Add-on TEC Controller available
LDD-1301		0–20 A / 0.5–45 V	1 ms – CW
LDD-1303		0–20 A / 1–120 V	1 ms – CW
LDD-1137		0–75 A / 0–70 V	1 ms – CW
LDD-1124		0–1.5 A / 0–15 V	CW, modulated modes
LDD-1121		0–15 A / 0–15 V	1 µs – CW, modulated, QCW and pulsed modes
LDD-1125		0–30 A / 0–27 V	1 µs – CW, modulated, QCW and pulsed modes
TEC Controllers			
Single-Channel Models	TEC-1092	±1.2 A / ±9.6 V	Micro
	TEC-1091	±4 A / ±21 V	Small
	TEC-1089	±10 A / ±21 V	Medium
	TEC-1162	±5 A / ±56 V	Medium-high
	TEC-1090	±16 A / ±30 V	Large
	TEC-1163	±25 A / ±56 V	Extra-large
Dual-Channel Models	TEC-1161-4A	2 x (±4 A / ±21 V)	Small
	TEC-1161-10A	2 x (±10 A / ±21 V)	Medium
	TEC-1122	2 x (±10 A / ±21 V)	Medium
	TEC-1166	2 x (±5 A / ±56 V)	Medium-high
	TEC-1123	2 x (±16 A / ±30 V)	Large
	TEC-1167	2 x (±25 A / ±56 V)	Extra-large

6 CHANGE HISTORY

Date of change	Version	Changed / Approved	HW Version
April 20, 2026	N	NJ / RS	v1.60
Change / Reason • Mod: Datasheet design • Del: Old Ordering codes • Add: Standardized product designations and ordering codes tables			

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