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LDD-1301

Hardware Version v1.21

The LDD-1301 is a current driver designed to precision-drive laser diodes or other loads in CW. Featuring fully digital current and optional light power control, various safety features and comprehensive communication interfaces, it offers a complete solution for continuous or modulated 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:** 10.5 – 60 VDC
- **Laser Diode Driver:**
  - Compliance Voltage: 0.5 – 53 V
  - Output Current: 0 – 20 A
  - Efficiency: > 95 % (@ > 50 % Load)
  - Ultra-Fast Switch-off for optimal LD protection
  - 1 ms – CW operation
  - High output current resolution (2 mA) and low ripple (< 0.4 %)
- Dimensions: 100 × 70 × 20 mm
- Digital PID-controlled current source with internal signal generator and LUT
- Safety features: Interlock input and overvoltage/ -current/ -temperature protection
- Easy configuration via provided GUI software
- Stand-alone or remote-controlled operation via USB (isolated), RS485, RS232 TTL or CANopen CiA 301
- GPIO features for monitoring and control (Enable, 4-Wire Fan, Error Indication, etc.)
- Optional LPC feature 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-1321	0–1.5 A / 0–14 V	CW, Add-on TEC Controller available	lower power
LDD-1121	0–15 A / 0–15 V	1 µs – CW, modulated, QCW and pulsed modes	pulsing, lower power
LDD-1137	0–75 A / 0–70 V	1 ms – CW, modulated	higher power
LDD-1303	0–20 A / 1–120 V	1 ms – CW	higher voltage

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	$U_{IN, DC}$		63	V
	U_{OUT}		U_{IN}	V
Current	I_{IN} (On Board Fuse)		20	A
	I_{OUT}		25	A

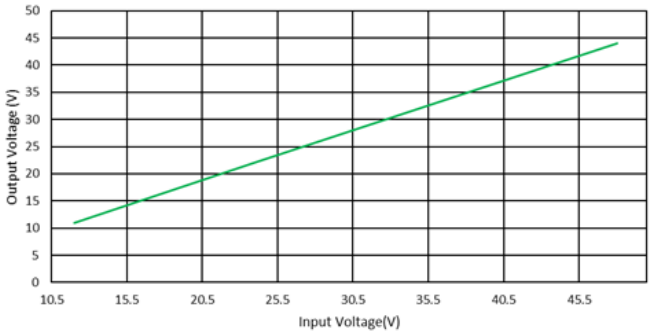
1 Operation at or beyond the absolute maximum ratings may result in permanent device damage. These limits are stress ratings only and functional operation of the device at these conditions is not guaranteed. Prolonged exposure to absolute maximum conditions can adversely affect long-term reliability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

1.2 Operating Characteristics

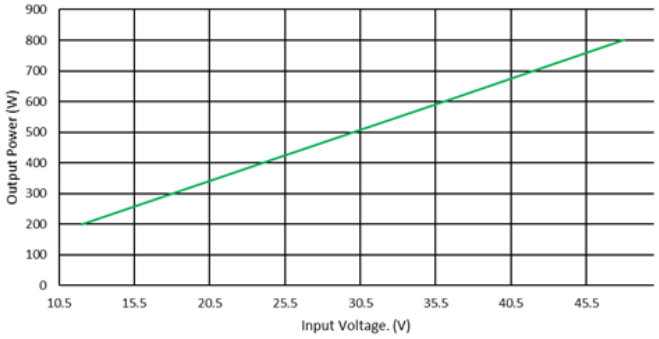
		Min	Max	Unit
Temperature	Operation Temperature	0	50	°C
	System Base Plate		50	°C
	Storage	–40	80	°C
Humidity	RH_{OP}, non-condensing	5	95	%

Unless otherwise noted: T_A = 25 °C, U_{IN} = 48 V

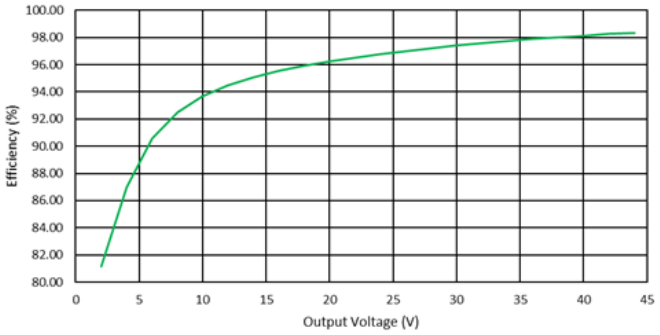
Max. Output Voltage vs. Input Voltage



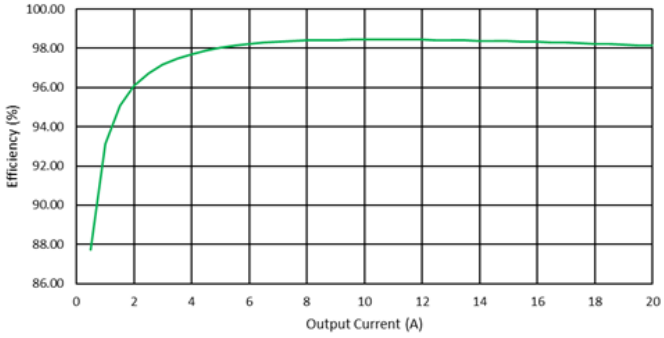
Max. Output Power vs. Input Voltage



Efficiency vs. Output Voltage @ 20 A Output Current



Efficiency vs. Output Current @ 40 V Output Voltage



1.3 Electrical Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 48 V, U_{LD} = 44 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
DC Power Supply Input:						
U_{IN}	Supply voltage		10.5	48	60	V
U_{IN_RIPPLE}	Ripple tolerance [1]			300		mV_{PP}

1 Input ripple voltage can directly influence the ripple current at the output.

1.4 Laser Output Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 48 V, U_{LD} = 44 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Output CW:						
I_{OUT}	Current range		0		20	A
$T_{coefficient}$	Temp. coefficient	I_{out} = 20A , T_A = 10 – 50 °C		155		ppm/K
I_{OUT_RES}	Current resolution			2		mA
I_{OUT_RIPPLE}	Current ripple pp	I_{out} > 2A		0.5 [1]		%
I_{OUT_ACC}	Current accuracy	Calibrated		14.8		mA
U_{OUT_LIMIT}	Output voltage limit	U_{IN} = 60 V	53			V
		U_{IN} = 24 V	20			V
		U_{IN} = 12 V	10			V
U_{OUT_ACC}	Voltage accuracy	Calibrated, I_{out} < 1 A		100		mV
P_{OUT}	Output power	U_{LD} = 40 V			800	W
I_{OUT_Rise}	Output current rise time	10 – 90%, PID Optimized, L_{Load} < 500 nH, I_{OUT} = 20 A			250	µs

1 Measured at I_{OUT} = 20 A and U_{LD} = 40 V

1.5 Safety Characteristics

Unless otherwise noted: T_A = 25 °C, U_{IN} = 48 V, U_{LD} = 40 V

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
I/O Ports:						
$t_{OFF\_CURRENT}$	Overcurrent				50	µs
t_{OFF_OPVAL}	Operating Values	Voltages, currents			100	µs
t_{OFF_SFAIL}	System failure	System status			250	µs

1.6 External Temperature Measurement (NTC only)

T_A = 25 °C, measurement configuration = 12 bit / 2-wire / unshielded cable < 50 mm, °T probe = NTC $B_{25/100}$ 3988K R_{25} 10k

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
$R_{LR,\ RANGE}$	Measurement range		295 ≈ 130		106400 ≈ –21	Ω °C

2 FUNCTIONAL DESCRIPTION

2.1 Current-Controlled Operation Modes and Communication Options

The LDD-1301 is an OEM high performance current source that is primarily designed to operate in CW. It is configured over an industry-standard RS485, RS232 TTL 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-1301 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, etc. Please refer to the user manual for further information.

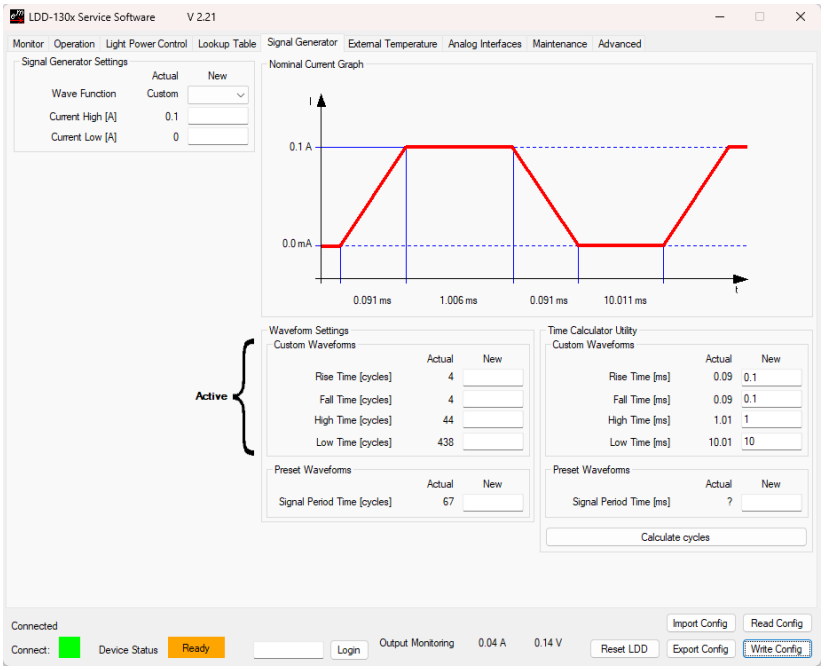
2.2 Service Software

The included Service Software is a powerful tool that allows monitoring and full configuration of the LDD-1301 via a standard USB, RS485 or an RS232 TLL 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
- 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 by Internal Generators.

3 INTERFACES AND CONNECTORS

3.1 General Purpose Digital I/O Characteristics (GPIO1 ... GPIO10)

Unless otherwise noted: T_A = 25 °C

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Input Characteristics:						
U_{IH}	Logic high input threshold		2			V
U_{IL}	Logic low input threshold				1	V
U_{IMAX}	Maximum input voltage	General Purpose Inputs are 5V-tolerant	-0.3		5.5	V
Output Characteristics:						
U_{OH}	Logic high output voltage	Output current 8 mA	2.8	3.3	3.4	V
U_{OL}	Logic low output voltage	Input current 8 mA			0.4	V
Z_{OUT}	Output Impedance		110	120	150	Ω
I_{OUT}	Output Sink or Source Current			±8	±20	mA
ESD Protection:						
U_{PP}	ESD discharge	IEC61000-4-2		18		kV

3.2 Analog Input and Output Characteristics

Unless otherwise noted: T_A = 25 °C. Voltages referenced to X2 (GND)

Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Input Characteristics:						
U_{I+}	Voltage at the Analog IN+ Pin		-1		11	V
U_{I-}	Voltage at the Analog IN– Pin		-1		11	V
U_{IN}	Nominal Input Voltage (difference between IN+ and IN–)		0		10	V
Output Characteristics:						
U_O	Analog Output Voltage		0		10	V
I_{OUT}	Analog Output Current				20	mA

3.3 Interlock Input Characteristics

Unless otherwise noted: T_A = 25 °C.

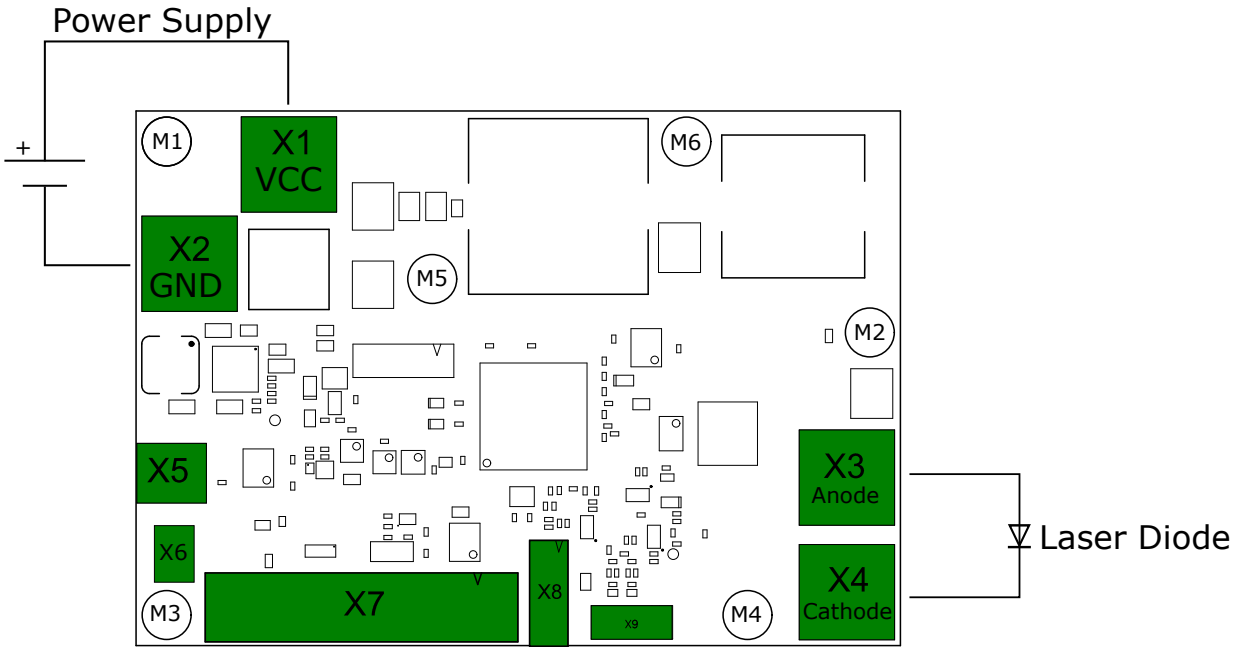
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Input Characteristics:						
U_{IACT}	Interlock active input voltage range	Voltage range which is detected as active input	3		30	V
U_{IORM}	Maximum Working Insulation Voltage				120	V

3.4 Photodiode Input Characteristics (only available with PD feature)

Unless otherwise noted: T_A = 25 °C.

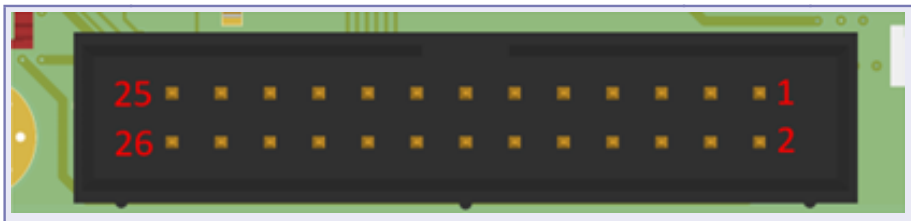
Symbol	Parameter	Test Conditions / Hints	Min	Typ	Max	Unit
Input Characteristics:						
I_{IN}	Photodiode current	PD4	0		4	mA
		PD2	0		2	
		PD1	0		1	
		PD0.5	0		0.5	

3.5 Device Connectors Overview



3.6 Interface Connector X7

Mating Connector: Würth 61202623021



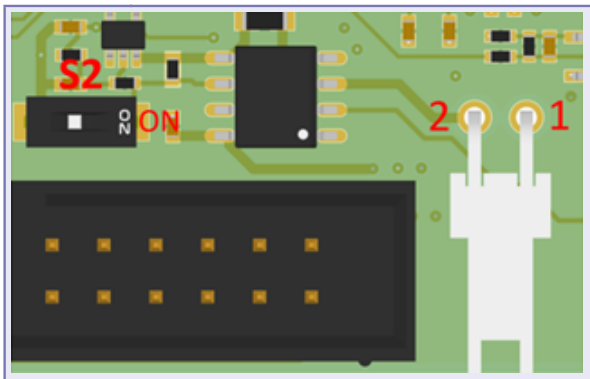
PIN 1	+5V	PIN 14	GPIO4
PIN 2	GND	PIN 15	GPIO5
PIN 3	+3.3V	PIN 16	GPIO6
PIN 4	RS485 1 A/D+	PIN 17	GPIO7
PIN 5	RS485 1 B/D–	PIN 18	GPIO8
PIN 6	RS232 TTL RX	PIN 19	GPIO9
PIN 7	RS232 TTL TX	PIN 20	GPIO10
PIN 8	GND	PIN 21	Not Connected/Reserved
PIN 9	CAN H	PIN 22	Not Connected/Reserved
PIN 10	CAN L	PIN 23	Analog GND
PIN 11	GPIO1	PIN 24	0–10V Analog Out
PIN 12	GPIO2	PIN 25	0–10V Analog IN+
PIN 13	GPIO3	PIN 26	0–10V Analog IN–

3.7 Interlock Connector X8

To enable the LDD, apply a voltage between the Interlock + and Interlock – Pins. The Interlock Pins are galvanically isolated from the LDD.

The DIP-Switch S2 can be switched ON to disable the Interlock functionality.

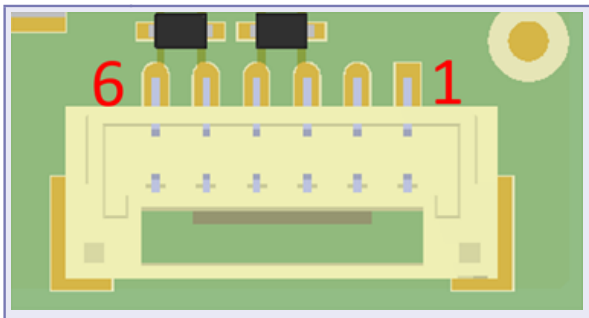
Mating connector: Molex 0022013027



PIN 1	Interlock +	PIN 2	Interlock –

3.8 Temperature and Light Measurement Connector X9

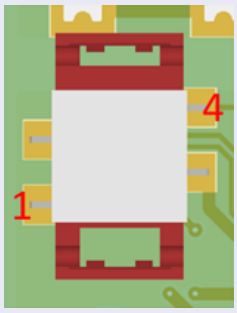
Mating Connector: JST GHR-06V-S



PIN 1	Photo Diode Anode	PIN 4	NTC 2 B
PIN 2	Photo Diode Cathode	PIN 5	NTC 1 A
PIN 3	NTC 2 A	PIN 6	NTC 1 B

3.9 AUX Connector X6

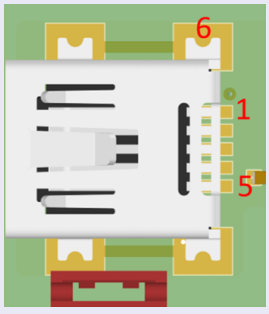
Mating Connector: Würth 690157000472



PIN 1	+5V	PIN 3	CAN H
PIN 2	GND	PIN 4	CAN L

3.10 USB Connector X5

Mating Connector: USB Mini Type B

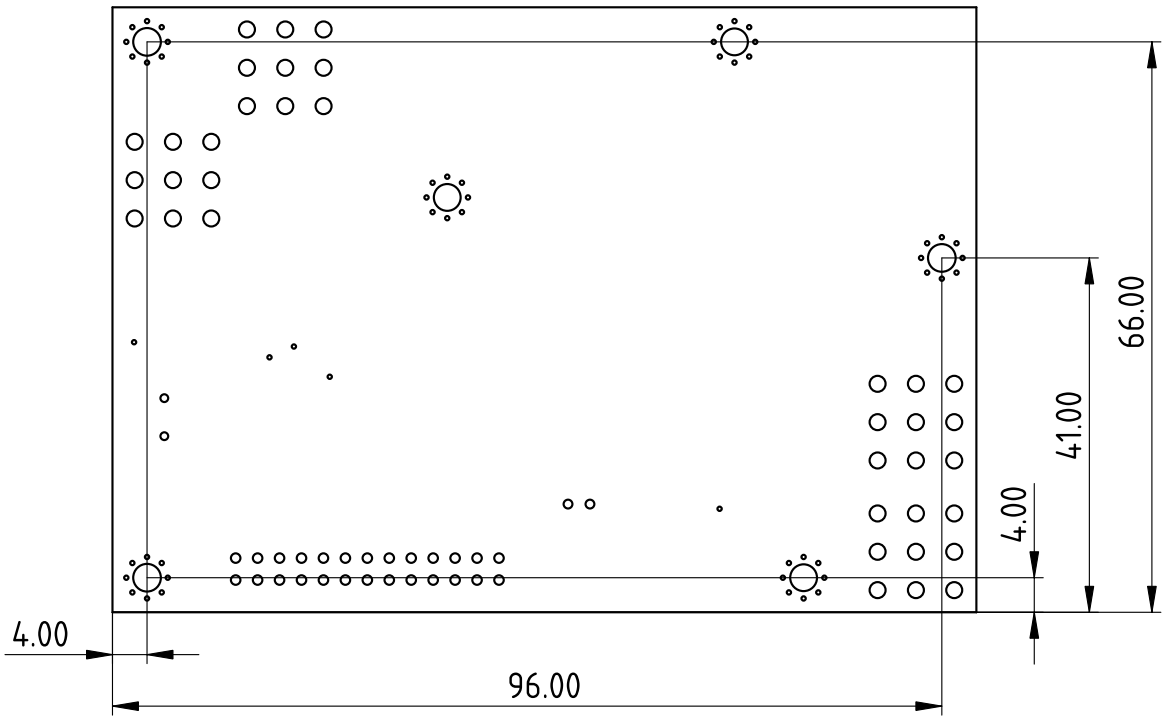


PIN 1	+5V	PIN 4	ID (not used)
PIN 2	DATA–	PIN 5	GND
PIN 3	DATA+	PIN 6	SHIELD

4 MECHANICAL DATA

4.1 Dimensions and Mounting Holes

The three holes can be used to mount the device onto a heatsink. Hole diameter = 3.2 mm.
All measurements are in mm. A 3D model of the device is available on our website.



Vertical height: 20 mm.

5 ORDERING AND CONFIGURATION

5.1 LDD-1301 Ordering Information & Configuration

Example Configuration:
LDD-1301 (PD4) FW2.21

Variant Name	Requirement	Description	Options / Single choice
Photodiode Input Type	**Required**	**Select the maximum measurable photodiode current in mA. Default: PD4, 4mA. Laser power control feature sold separately.**	**PD4, PD2, PD1, PD0.5**
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: FW2.21
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: HW1.21

5.2 Ordering Confirmation Example

LDD-1301 (PD4, HW1.21)
Firmware Version: FW2.21

String can additionally contain:
Profile: Default

6 ALL MEERSTETTER ENGINEERING PRODUCTS

6.1 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

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7 CHANGE HISTORY

Date of change	Version	Changed / Approved	HW Version
March 1, 2022	B	ME / ME	
Change / Reason • Preliminary information			
April 21, 2022	C	HS / PV	
Change / Reason • Add Change History • Add Connector Drawings and Pinout • Add Ripple and Rise Time Values • Update max compliance voltage to 45V			
April 21, 2022	C	RS / CU	
Change / Reason • Edit compliance/output voltage text for clarity			
April 21, 2022	C	CU / HS	
Change / Reason • Change current ripple unit • Add ripple current footnote to clarify			
April 21, 2022	C	HS / RS	
Change / Reason • Remove redundant efficiency figures			
July 19, 2022	D	RS / CU	
Change / Reason • LPC option now defined in product string, new configurations available • Photodiode input is only available with the LPC Option • Temperature coefficient added			
July 19, 2022	E	CU / RS	
Change / Reason • Hardware version increased to 1.20 • Formatting			

Date of change	Version	Changed / Approved	HW Version
September 23, 2022	F	ML / CU	
Change / Reason • Add CANopen feature and Pin definition			
October 26, 2022	F	CU / HS	
Change / Reason • Input Characteristics and Absolute Maximum Ratings adapted, new device connector overview and second CAN pin definition added			
March 20, 2023	F	CU / RS	
Change / Reason • Absolute maximum input voltage modified			
December 11, 2023	G	CU / RS	
Change / Reason • Absolute maximum output voltage modified • Pictures of the device connectors updated • Pin assignment of the USB device connector added			
December 11, 2023	G	RS / HS	
Change / Reason • Specify maximum output voltage as of HWv1.20 with FWv1.41			
August 15, 2024	H	RS / HS	
Change / Reason • Add current accuracy and update voltage limit specifications • Update Hardware version			
June 3, 2025	J	RS / SC	v1.21
Change / Reason • New label system for photodiode input, label diagram replaced • Update voltage limit specifications			

Date of change	Version	Changed / Approved	HW Version
April 20, 2026	K	NJ / RS	v1.21
Change / Reason • Mod: Datasheet design • Del: Old Ordering codes • Add: Standardized product designations and ordering codes tables • Add: Functional Description			

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