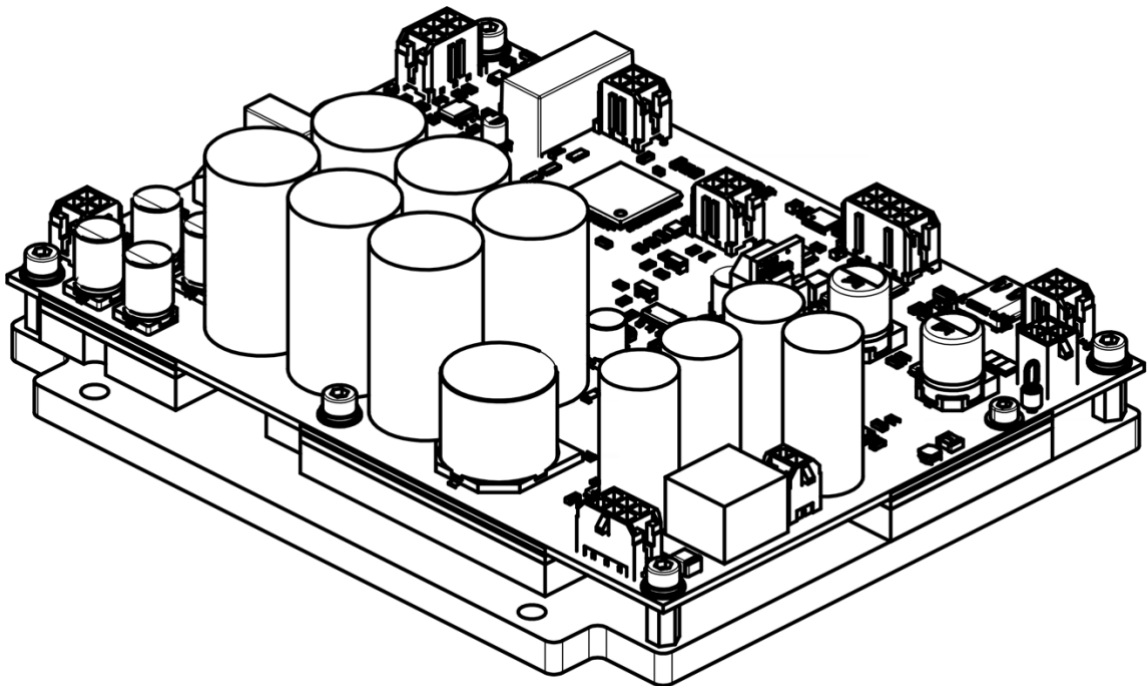


## SDC-200-series diode driver

### User manual



**Warning!** This equipment can be dangerous.  
Please read this entire user manual carefully before operating the product.

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## Overview

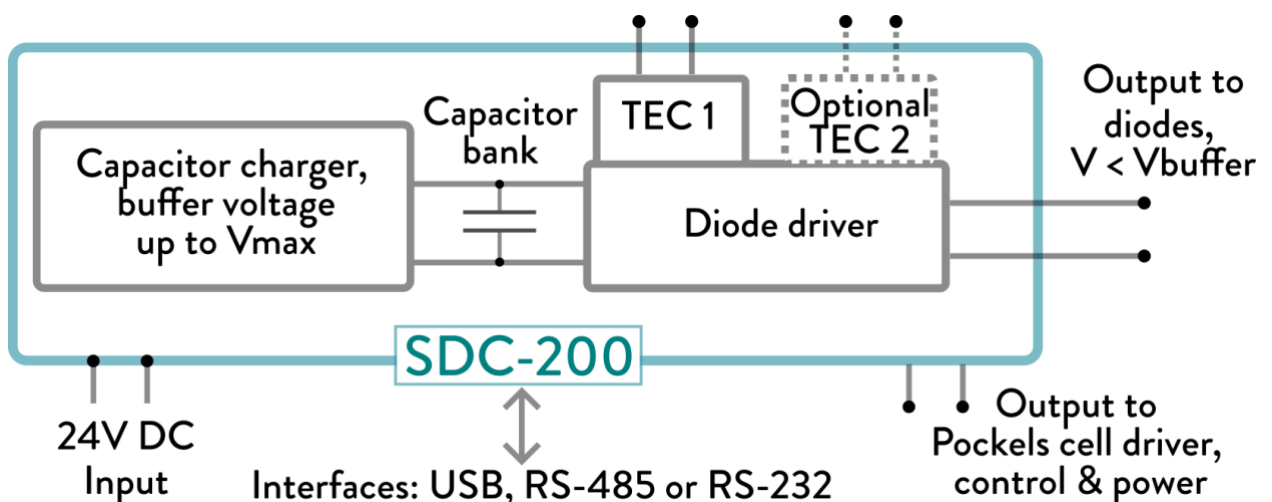
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SDC-200 is a family of laser diode drivers designed for pumping medium-power Nd:YAG-like solid-state lasers. The driver has an embedded current source, buffer capacitor bank, capacitor charger, one or two TEC modules (see also the full driver's architecture in the picture below). It is also capable of powering and controlling a Pockels cell driver for generation of Q-switched pulses. The SDC-200 is able to send adjustable output synchronization signals to other equipment.

Main features of the SDC-200 drivers (may vary by part number):

- 24VDC input.
- Output current – several models, up to 400A.
- Diode voltage – several models, up to 450V (\*).
- Pulse widths are typical for Nd:YAG pumping (50-300us, wider on request), rise time is fast (20-30us typically), and adjustable (soft-start ramp to current setpoint).
- Maximum average output power is 100W.
- 1x high-power TEC onboard – 10A/20V/200W max.
- 1x low-power TEC onboard – 5A/20V/50W max.
- Control of an external Pockels cell driver (purchased separately and connected to the SDC-200 driver from outside), synchronization features.

(\*) See [How to order?](#) section for details.



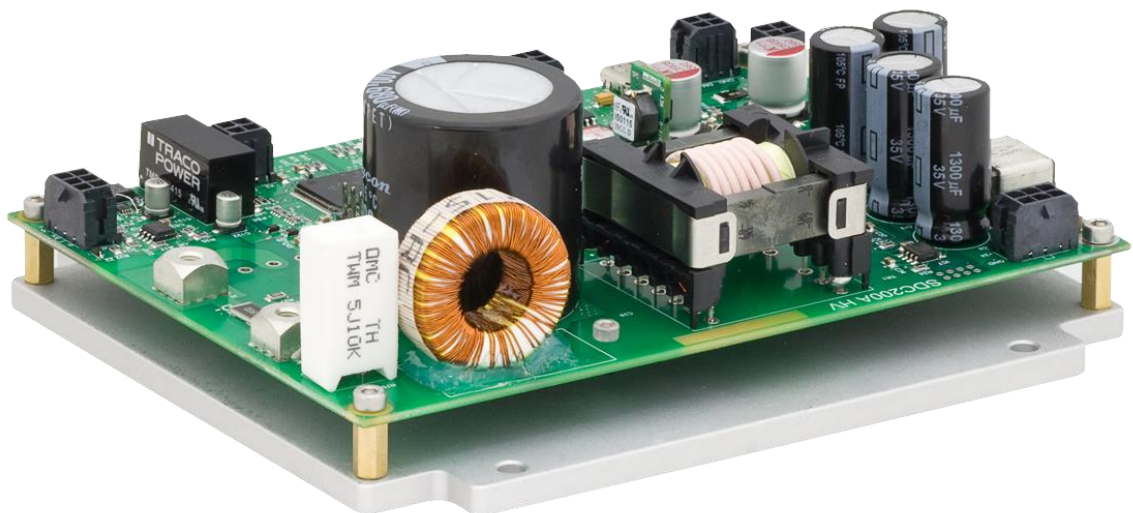
All the important parameters for SDC-200 laser diode driver (such as output current, buffer voltage, pulse width, pulse repetition rate and others) can be controlled from a computer via the USB or via the RS-485 interface. The default interface is the RS-485 (the RS-232 is available upon request).

## Appearance

### LOW-VOLTAGE VERSIONS



### HIGH-VOLTAGE VERSIONS



## Cooling

The driver is conductively cooled through the bottom-surface heatsink, which – depending on the actual heat dissipation – should be attached either to a massive chassis or to a cold plate of appropriate performance.

For better heat removal thermal grease or equivalent may be used.

## **Contents of delivery**

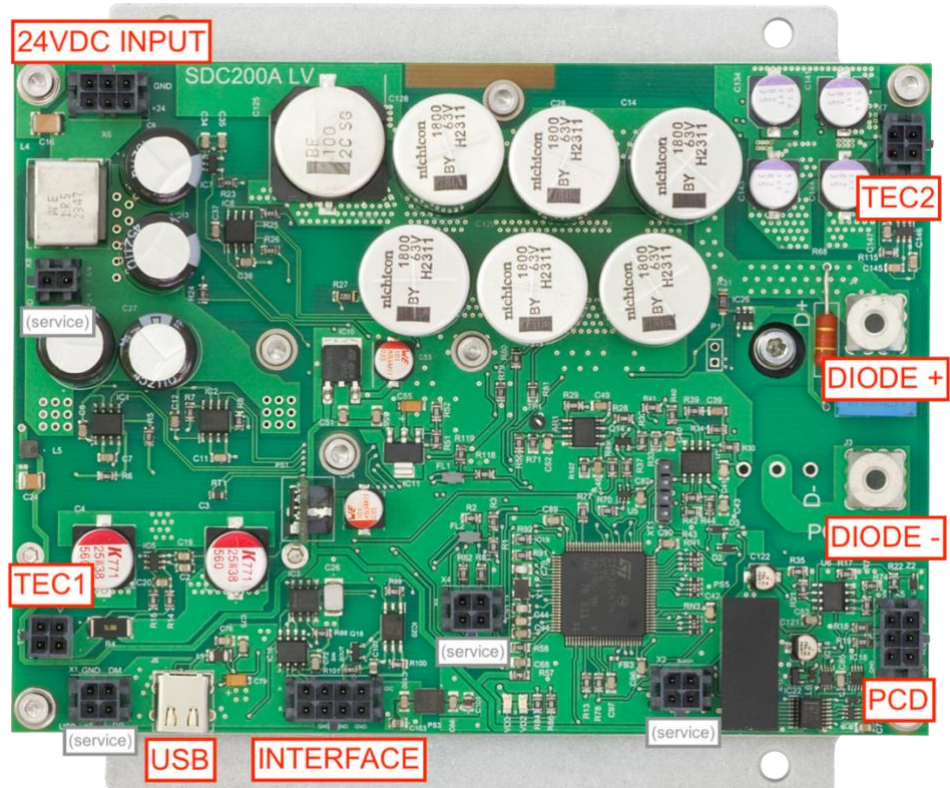
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By default, the delivery package contains the following parts:

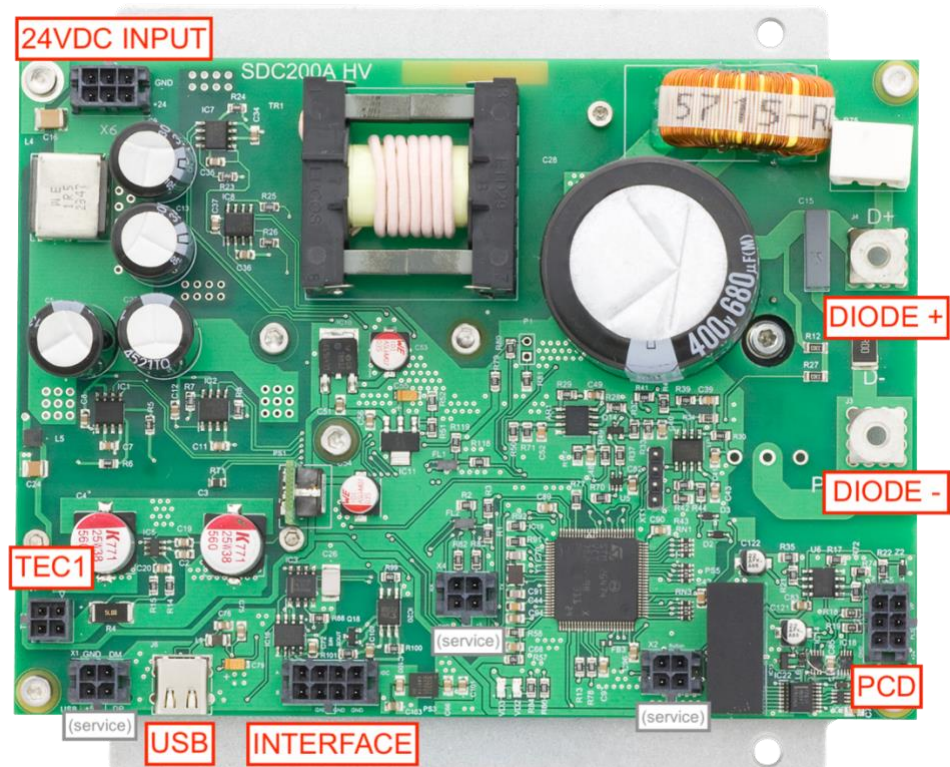
- SDC-200 diode driver – 1pc
- 24VDC INPUT mating cable (50cm length) – 1pc
- DIODE mating cable (50cm length) – 2pcs
- TEC mating cable (50cm length) – 1-2pcs (depends on model)
- INTERFACE mating cable (50cm length) – 1pc
- PCD mating cable (to a Pockels cell driver, 50cm length) – 1pc
- USB flash drive with PC software – 1pc

## Connectors, pins, interface signals

### LOW-VOLTAGE VERSIONS



### HIGH-VOLTAGE VERSIONS



### 24VDC INPUT: 6-PIN MOLEX MICRO-FIT

24VDC power to the driver.

6	5	4
3	2	1

PIN	DESIGNATION	DESCRIPTION
1, 2, 3 ( <b>red</b> )	+24V	Input positive (+24VDC)
4, 5, 6 ( <b>black</b> )	RETURN	Return from 24VDC power supply

### DIODE: M4 THREAD TERMINALS (2PCS)

PIN	DESIGNATION	DESCRIPTION
- ( <b>red</b> )	DIODE “+”	Diode’s anode
- ( <b>black</b> )	DIODE “-”	Diode’s cathode

#### **Important note**

Since the diode driver has no galvanic isolation between input and output, the diode’s anode will be at the buffer-voltage potential, and the diode’s cathode will be at a floating potential different from ground.

**Therefore, both the anode and the cathode must not be grounded in any manner and must be isolated from ground.**

**Note:** For better performance, we recommend keeping the inductance of the output cables as low as possible (the recommended value is <500nH).

### TEC 1: 4-PIN MOLEX MICRO-FIT+

Peltier connection.

High power, 200W/10A/20V max.



PIN	DESIGNATION	DESCRIPTION
1 ( <b>red</b> )	TEC +	Peltier red
2 ( <b>black</b> )	TEC -	Peltier black
3, 4 ( <b>blue</b> )	NTC	NTC 10kOhm connection

### TEC 2: 4-PIN MOLEX MICRO-FIT

Peltier connection.

Low power, 50W/5A/20V max.

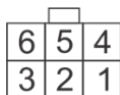


PIN	DESIGNATION	DESCRIPTION
1 ( <b>red</b> )	TEC +	Peltier red
2 ( <b>black</b> )	TEC -	Peltier black
3, 4 ( <b>blue</b> )	NTC	NTC 10kOhm connection

**Note:** Some modifications are supplied with TEC 1 only, see also [How to order?](#) section.

### PCD: 6-PIN MOLEX MICRO-FIT

Pockels cell driver connection. Recommended drivers are [QBD-series](#) and [QBU-series](#) offered by OEM Tech.

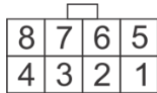


PIN (COLOR)	DESIGNATION	DESCRIPTION
1 ( <b>black</b> )	RETURN	Return of PCD circuits.
2 ( <b>green</b> )	PCD Enable	Enable signal to the Pockels cell driver.
3 (-)	N/C	-
4 ( <b>red</b> )	+24VDC	Power to the Pockels cell driver.

5 (blue)	Q-switch	Q-switch/Pulse signal to the Pockels cell driver. The signal can be configured to match the requirements of QBD-series and QBU-series Pockels cell drivers.
6 (yellow)	HV Program	HV Program signal to the Pockels cell driver.

### INTERFACE: 8-PIN MOLEX MICRO-FIT

SYNC IN, SYNC OUT, IDC, and RS-485 interface.



PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (green)	RS-485 A	RS-485 interface of SDC-200
2 (white)	SYNC IN	Synchro input (1kOhm input impedance, amplitude 5V TTL, pulse width >1us).
3 (yellow)	SYNC OUT	Synchro output (50 Ohm impedance, amplitude 5V, duration 5us). Sync out pulses are shifted relative to the trailing edge of the TTL pulse applied to the diode driver of SDC-200 by the specified delay. The delay can be positive or negative.
4 (orange)	IDC	Door-interlock connection
5 (violet)	RS-485 B	RS-485 interface of SDC-200
6 (transparent)	SYNC IN return	Return of the Synchro input signal
7 (blue)	SYNC OUT return	Return of the Synchro output signal
8 (black)	IDC return	Return of the IDC signal

### USB: TYPE-C

PC connection.

### GROUNDING

#### **Grounding policy**

Most of the SDC-200 circuits (24VDC, DIODE, TEC 1, TEC 2) have common ground. PCD, SYNC IN, SYNC OUT, and IDC are galvanically isolated from each other and other circuits. RS-485 and USB are galvanically isolated from other circuits, but not from each other.

## Safety

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**Warning!** This equipment produces high voltages that can be very dangerous. Be careful in a high-voltage appliances area.

- Assemble the entire setup before powering the device.
- Do not repair the driver yourself, there are no user-serviceable parts inside.
- Do not operate the device with load disconnected.
- Avoid casual contacts of personnel with output cables and with the load.
- Do not connect or disconnect cables while the driver is powered on.
- Do not turn on the driver if it has been damaged by water, chemicals, mechanical or electrical shock.

## Installation

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- If high-power operations are expected, install the SDC-200 on the appropriate heatsink or cold plate.
- Connect your diode to the driver's DIODE connectors.
- **Ensure that neither the diode's positive (anode) nor the diode's negative (cathode) is grounded in any way.**
- If necessary, connect your Peltier and a NTC thermistor to the driver's TEC1 connector. Make sure the NTC thermistor has good thermal contact with the diode heatsink. If required, an additional Peltier element and NTC thermistor can be connected to the TEC2 connector.
- If necessary, connect your Pockels cell driver to the driver's PCD connector.
- Organize your IDC connection (INTERFACE connector of the driver). Ensure that IDC circuit is "closed" when you start the operations.
- Connect the driver to the PC via USB connector. Install the Windows software from the USB flash drive supplied together with the SDC-200 driver.
- If synchronization is required, connect the SDC-200 with other equipment using the SYNC IN and SYNC OUT signals (INTERFACE connector of the driver).
- Connect the driver to the power source using 24VDC INPUT connector (power shouldn't be applied to the driver yet).

## Operations

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- Assemble your setup following the [Installation](#) section, now your driver is ready for work.

- Apply 24VDC power to the driver.
- Run demo software supplied together with the driver.
- Operate accordingly to the software description ([Appendix 2](#)).
- Remove 24VDC power from the driver.

## Faults

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The driver raises faults in the cases listed below.  
Some of them stop the operations, but some do not.

#	FAULT	DESCRIPTION / COMMENTS
1	OVERHEAT1	SDC-200 overheating (primary). This causes the diode driver to stop.
3	VOLTLOW	Buffer voltage is too low. The set buffer voltage is not sufficient to generate a current pulse of the specified value. This doesn't cause the diode driver to stop.
4	VOLTHIGH	Buffer voltage is too high. The set buffer voltage is much higher than required to generate a current pulse of the specified value, which causes overload of the internal components. The output pulse duration will be forcibly cut down to 70us. This doesn't cause the diode driver to stop.
7	TEC1	TEC 1 temperature is out of the allowed limits. This doesn't cause the diode driver to stop unless TEC stabilization is required to run diode driver.
8	TEC2	TEC 2 temperature is out of the allowed limits. This doesn't cause the diode driver to stop unless TEC stabilization is required to run diode driver.
9	OVERHEAT2	SDC-200 overheating (secondary). This causes the diode driver to stop.
11	IDC	Interlock is open. This causes the diode driver to stop.
12	DCDC	Buffer voltage power source failure. This causes the diode driver to stop.
13	POWER	Expected averaged output power is out of the allowed limits. This causes the diode driver to stop.
14	TECNR	TEC Not Ready – TEC 1 and/or TEC 2 is not stabilized. This is considered as a fault only if the corresponding TEC stabilization is required to run diode driver. In this case the diode driver will be stopped.

## Technical notes

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### OUTPUT CABLES

The output cables inductance affects the SDC-200 performance. The higher inductance is, the higher current overshoot is. For better performance, we recommend keeping inductance of the output cables below 500nH. The recommended length of the output cables is 50cm or shorter.

However, the SDC-200 allows to adjust the rise time to suppress current overshoot when the longer output cables are used.

### OUTPUT MEASUREMENT AND GROUNDING

Neither the DIODE “+” nor the DIODE “-” driver outputs may be grounded. Grounding either the DIODE “+” or DIODE “-” output may result in driver failure.

For the same reasons, do not connect an oscilloscope probe ground to DIODE “-” when measuring the output voltage. We recommend using differential probes for direct output voltage measurements.

## Specifications

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### ELECTRICAL

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<b>Input:</b>	
Input voltage	24VDC
Current consumption	<15A
<b>Output:</b>	
Regime of operations	Pulsed
Maximum buffer voltage ( $V_{MAX}$ )	Model dependent (user selectable up to 450V), other on request
Maximum output voltage	Model dependent (see also <a href="#">How to order?</a> section), other on request
Maximum output current ( $I_{MAX}$ or $I_{250}$ )	Model dependent (user selectable up to 400A), other on request $I_{MAX}$ is fully achievable at pulse widths up to 250us, and is derated at longer pulses
Output current	Adjustable from approx. 10% of $I_{MAX}$ to 100% of $I_{MAX}$ , other on request
Buffer voltage	Adjustable in 10... $V_{MAX}$ range, other on request
Pulse width	Adjustable in 50... $T_{MAX}$ range, $T_{MAX}$ is 300us by default, other on request
Pulse repetition rate	Adjustable up to 50-100Hz, other on request
Peak power	Model dependent (in ~20-50kW range), other on request
Maximum average output power	100W, other on request
Rise time	<20-30us typically, slow start adjustable in 0...50us range
Bias current	+, model dependent (~50-100mA)
<b>TEC1:</b>	
Current	Up to 10A
Voltage	Up to 20V
Power	200W max.
Feedback loop	10kOhm NTC
Temperature	+10 ... +40 °C by default, other on request
<b>TEC2:</b>	

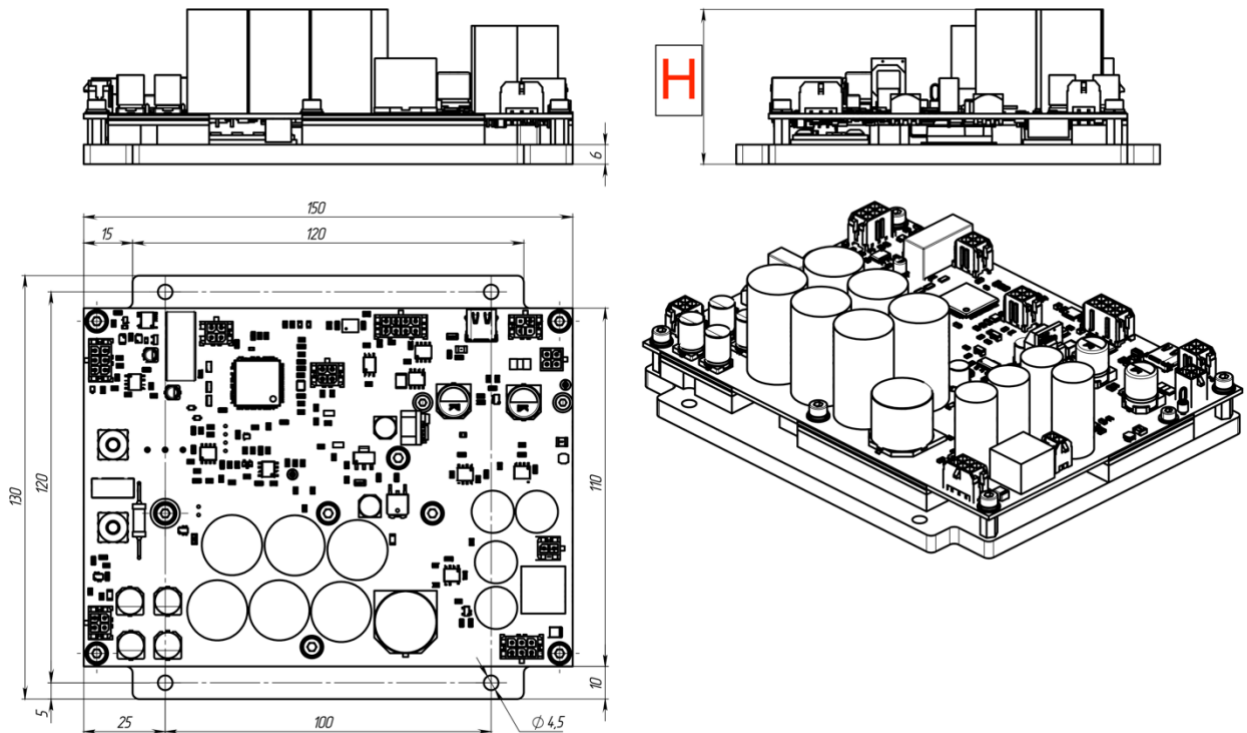
Current	Up to 5A
Voltage	Up to 20V
Power	50W max.
Feedback loop	10kOhm NTC
Temperature	+10 ... +40 °C by default, other on request
<b>Interfaces:</b>	
USB	+
RS-485 (RS-232 on request)	+
<b>Protections:</b>	Door-interlock connection, overheating, buffer voltage too low, buffer voltage too high, TEC1 out of range, TEC2 out of range, input frequency is too high
<b>Cooling:</b>	Conductive cooling through the bottom heatsink
<b>Other:</b>	
Synchro input	+
Synchro output	+
Pockels cell driver control	+ (The Pockels cell driver needs to be purchased separately, placed outside and connected with a cable)
<b>Environmental:</b>	
Operating temperature	+10 ... +40 °C
Storage temperature	-20 ... +60 °C
Humidity	<90%, non-condensing

## MECHANICAL

Size (WxDxH)	From 150x130x50mm to 150x130x60mm (see also dimensional drawings below)
Weight	<0.5kg

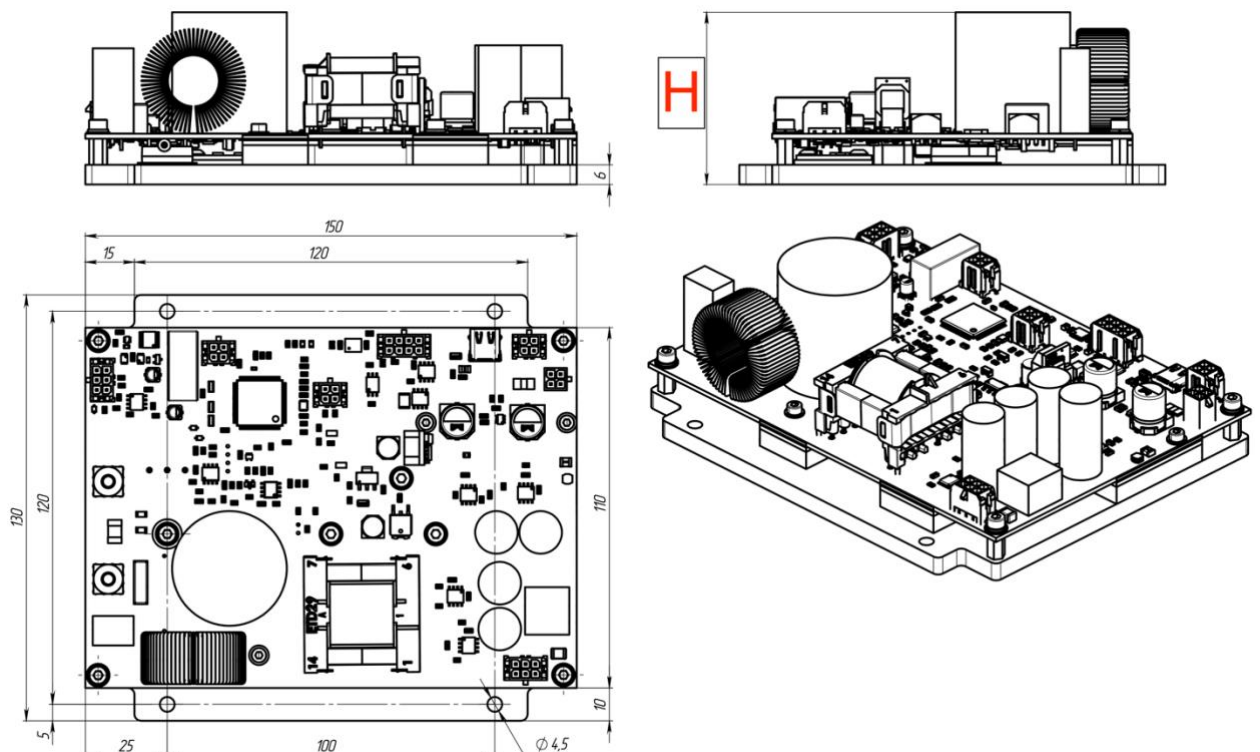
## Dimensional drawings

### LOW-VOLTAGE VERSIONS



Height (H) is model dependent and can be found in [How to order?](#) section.

### HIGH-VOLTAGE VERSIONS



Height (H) is model dependent and can be found in [How to order?](#) section.

## How to order?

SDC-200-XXXX-[YYYY]-[VVVVV], where:

- XXXX codes the voltage version of the driver (nominal value, can be 63V, 80V, 100V, 126V, 160V, 200V, 250V, 400V, 450V, or custom). The maximum output current, internal capacitor bank capacitance, average output power, and number of TECs are fixed for each voltage version, see details in the table below.
- YYYY codes low-current and high-current versions of the driver. The low-current versions are optimized for low-current diodes and for operating regimes with low energy but high repetition rates. It is reasonable to choose a low-current version, which provides improved output-current quality in the low-current region, if the maximum operating current in your system is at least three times lower than the  $I_{MAX}$  of the standard model. If not specified, the standard version is supplied.
- VVVVV code defines the type of communication interface, it can be either RS232 or RS485. By default, the RS485 version is supplied.

### LOW-VOLTAGE VERSIONS

Parameter	Value <sup>(1)</sup>			
Model P/N	SDC-200-63V	SDC-200-80V	SDC-200-100V	SDC-200-126V
Embedded capacitor bank:				
Voltage ( $V_{MAX}$ )	63V	80V	100V	126V
Capacitance	10.8mF	10.8mF	6.0mF	3.6mF
Capacitor charging power supply:				
Buffer voltage	10V...63V	10V...80V	10V...100V	10V...126V
Maximum power in dependence on buffer voltage <sup>(2)</sup>	>100W @ 30V...63V	>100W @ 30V...80V	>100W @ 30V...100V	>100W @ 30V...126V
Diode driver:				
Maximum output current:				
- @ 250us ( $I_{250}$ )	350A	350A	300A	250A
- @ 300us ( $I_{300}$ )	300A	300A	250A	200A
Minimum output current ( $I_{MIN}$ )	10A	10A	10A	10A
Recommended diode voltage <sup>(3)</sup> :				
- @ $I_{300}$ , 300us	<46V	<63V	<79V	<96V
- @ $\frac{1}{2} I_{250}$ , 250us	<50V	<69V	<87V	<107V
Maximum pulse width ( $T_{MAX}$ )	300us	300us	300us	300us
Minimum pulse width	50us	50us	50us	50us
Maximum repetition rate <sup>(4)</sup>	100Hz	100Hz	100Hz	100Hz
Output limitations:				

Energy limit <sup>(4)</sup> ( $I_{300} * V_{MAX} * T_{MAX}$ )	~5.6J	~7.2J	~7.5J	~7.5J
Power limit	100W	100W	100W	100W
Guaranteed regimes	300A/46V/300us/15Hz 100A/25V/250us/100Hz	300A/63V/300us/10Hz 100A/25V/250us/100Hz	250A/79V/300us/10Hz 100A/25V/250us/100Hz	200A/96V/300us/10Hz 100A/25V/250us/100Hz
TEC 1	+	+	+	+
TEC 2	+	+	+	+
Height (H)	<50mm	<55mm	<50mm	<60mm
<b>Low-current versions</b>	<b>SDC-200-63V-100A</b>	<b>SDC-200-80V-100A</b>	<b>on request</b>	<b>on request</b>
$I_{250} / I_{300}$	100A / 100A	100A / 100A	–	–
$I_{MIN}$	5A	5A	–	–
Height (H)	<50mm	<55mm		
<b>High-current versions</b>	<b>SDC-200-63V-400A</b>	<b>SDC-200-80V-400A</b>	<b>on request</b>	<b>on request</b>
Capacitance	14.4mF	14.4mF	–	–
$I_{250} / I_{300}$	400A / 350A	400A / 350A	–	–
$I_{MIN}$	10A	10A	–	–
Recommended diode voltage <sup>(3)</sup> : - @ $I_{300}$ , 300us - @ $\frac{1}{2} I_{250}$ , 250us	<44V <52V	<61V <69V	–	–
Guaranteed regimes	400A/44V/250us/10Hz 350A/44V/300us/10Hz	400A/44V/250us/10Hz 350A/44V/300us/10Hz	–	–
Height (H)	<60mm	<60mm	–	–

- (1) Customizations (e.g. non-standard output currents, non-standard diode voltages and other parameters, software customizations, Pockels cell driver control customizations) are possible on request. Please contact the manufacturer for the details.
- (2) In dependence on the topology of the internal DC/DC power converter the dependence of the output power of the capacitor charger from the output voltage is principally different for different models of SDC-200. Low-voltage models deliver full output power in a wide range of the output voltages. Unlike them, high-voltage models are able to deliver full output power close to  $V_{MAX}$  only. At lower output voltages the output power of high-voltage models drops approx. linearly with the decreasing output voltage.
- (3) Please note that the output voltage applied to the diodes is always lower than the buffer voltage due to voltage drops across internal components and wiring. The higher output current and pulse width are, the lower output voltage is possible with the same buffer voltage. On the contrary, the possible output voltage reaches exactly the buffer voltage at very low currents and pulse widths.
- (4) If the diode voltage is close to  $V_{MAX}$  and the operating current is close to  $I_{MAX}$ , the typical pulse energy is ~5–7J, and 100Hz operation is not possible due to the 100W average power limitation. Therefore, 100Hz operation is only possible when the operating current and/or voltage are several times lower than  $I_{MAX}$  and  $V_{MAX}$ , respectively. In such cases, it may be reasonable to consider a low-current version of the driver.

Examples:

- SDC-200-100V – fully standard 100V version with all the parameters as given above
- SDC-200-63V-100A-RS232 – low-current version of 63V model, also with RS-232 communication interface instead of RS-485

## HIGH-VOLTAGE VERSIONS

Parameter	Value <sup>(1)</sup>			
Model P/N	SDC-200-160V	SDC-200-200V	SDC-200-250V	SDC-200-400V
Embedded capacitor bank:				
Voltage ( $V_{MAX}$ )	160V	200V	250V	400V
Capacitance	2.7mF	2.2mF	1.5mF	820uF
Capacitor charging power supply:				
Buffer voltage	10V...160V	10V...200V	10V...250V	10V...400V
Maximum power in dependence on buffer voltage <sup>(2)</sup>	>100W @ 160V	>100W @ 200V	>100W @ 250V	>100W @ 400V
Diode driver:				
Maximum output current:				
- @ 250us ( $I_{250}$ )	225A	200A	175A	125A
- @ 300us ( $I_{300}$ )	200A	175A	150A	100A
Minimum output current ( $I_{MIN}$ )	10A	10A	10A	5A
Recommended diode voltage <sup>(3)</sup> :				
- @ $I_{300}$ , 300us	<118V	<144V	<196V	<333V
- @ $\frac{1}{2} I_{250}$ , 250us	<137V	<161V	<223V	<357V
Maximum pulse width ( $T_{MAX}$ )	300us	300us	300us	300us
Minimum pulse width	50us	50us	50us	50us
Maximum repetition rate <sup>(4)</sup>	50Hz	50Hz	50Hz	50Hz
Output limitations:				
Energy limit <sup>(4)</sup> ( $I_{300} * V_{MAX} * T_{MAX}$ )	~9.6J	~10.5J	~11.2J	~12.0J
Power limit	100W	100W	100W	100W
Guaranteed regimes	225A/137V/250us/10Hz 110A/140V/250us/20Hz 50A/120V/250us/50Hz	200A/160V/250us/10Hz 100A/150V/250us/20Hz 50A/110V/250us/50Hz	150A/195V/250us/10Hz 100A/148V/250us/20Hz 50A/105V/250us/50Hz	100A/330V/250us/10Hz 50A/360V/250us/20Hz 50A/100V/250us/50Hz
TEC 1	+	+	+	+
TEC 2	N/A	N/A	N/A	N/A
Height (H)	<60mm	<60mm	<60mm	<60mm
<b>Alternative versions</b>	<b>on request</b>	<b>on request</b>	<b>on request</b>	<b>SDC-200-450V</b>
Capacitance	-	-	-	780uF
$I_{250}$ / $I_{300}$	-	-	-	125A / 100A
$I_{MIN}$	-	-	-	5A

Recommended diode voltage <sup>(3)</sup> : - @ I <sub>300</sub> , 300us - @ 1/2 I <sub>250</sub> , 250us	–	–	–	<371V <403V
Guaranteed regimes	–	–	–	100A/330V/250us/10Hz 50A/360V/250us/20Hz 50A/120V/250us/50Hz
Height (H)	–	–	–	<60mm

(1) Customizations (e.g. non-standard output currents, non-standard diode voltages and other parameters, software customizations, Pockels cell driver control customizations) are possible on request. Please contact the manufacturer for the details.

(2) In dependence on the topology of the internal DC/DC power converter the dependence of the output power of the capacitor charger from the output voltage is principally different for different models of SDC-200. Low-voltage models deliver full output power in a wide range of the output voltages. Unlike them, high-voltage models are able to deliver full output power close to V<sub>MAX</sub> only. At lower output voltages the output power of high-voltage models drops approx. linearly with the decreasing output voltage.

(3) Please note that the output voltage applied to the diodes is always lower than the buffer voltage due to voltage drops across internal components and wiring. The higher output current and pulse width are, the lower output voltage is possible with the same buffer voltage. On the contrary, the possible output voltage reaches exactly the buffer voltage at very low currents and pulse widths.

(4) If the diode voltage is close to V<sub>MAX</sub> and the operating current is close to I<sub>MAX</sub>, the typical pulse energy is ~10–15J, and 50Hz operation is not possible due to the 100W average power limitation. Therefore, 50Hz operation is only possible when the operating current and/or voltage are several times lower than I<sub>MAX</sub> and V<sub>MAX</sub>, respectively. In such cases, it may be reasonable to consider a low-current version of the driver.

Examples:

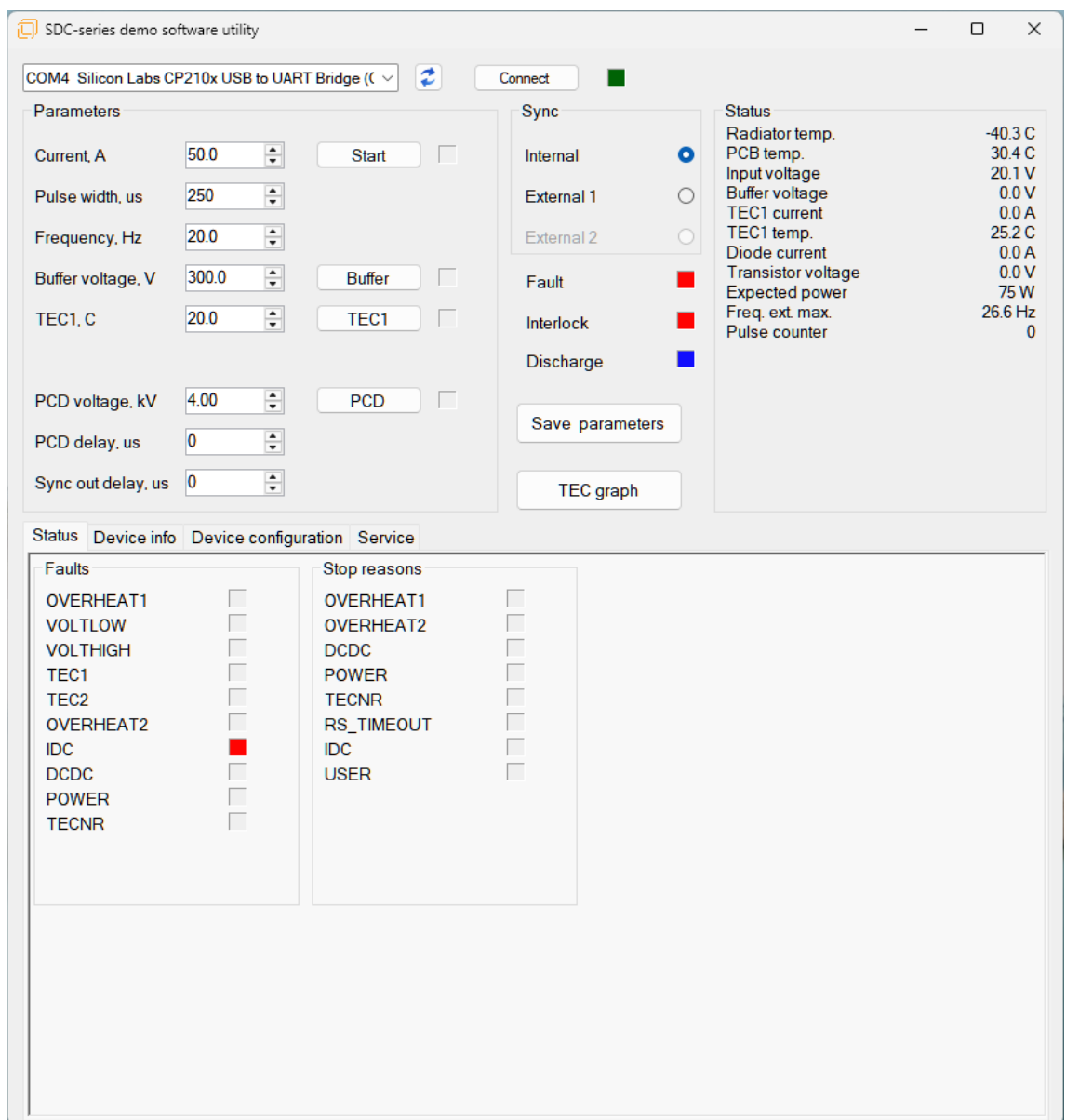
- SDC-200-400V – fully standard 400V version with all the parameters as given above
- SDC-200-250V-RS232 – standard 250V version, but with RS-232 communication interface

## Appendix 1: RS-232 / RS-485 communication protocol, its description

A complete description of the current version of the RS-485 communication protocol is supplied with the SDC-200 diode driver. Please request the description from the manufacturer if you need it in advance.

## Appendix 2: Demo PC software, its description

Additionally, we provide a demo software utility, which is supplied for free together with SDC-200-series diode drivers to simplify their integration into high-level customer's systems. Please request the description from the manufacturer if you need it in advance.



### Appendix 3: Bench-top version

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A bench-top version (with enclosure and graphic UI) for easy and unattended laboratory use is also available. Please see description of [SDC-BT diode drivers](#) for the details.

