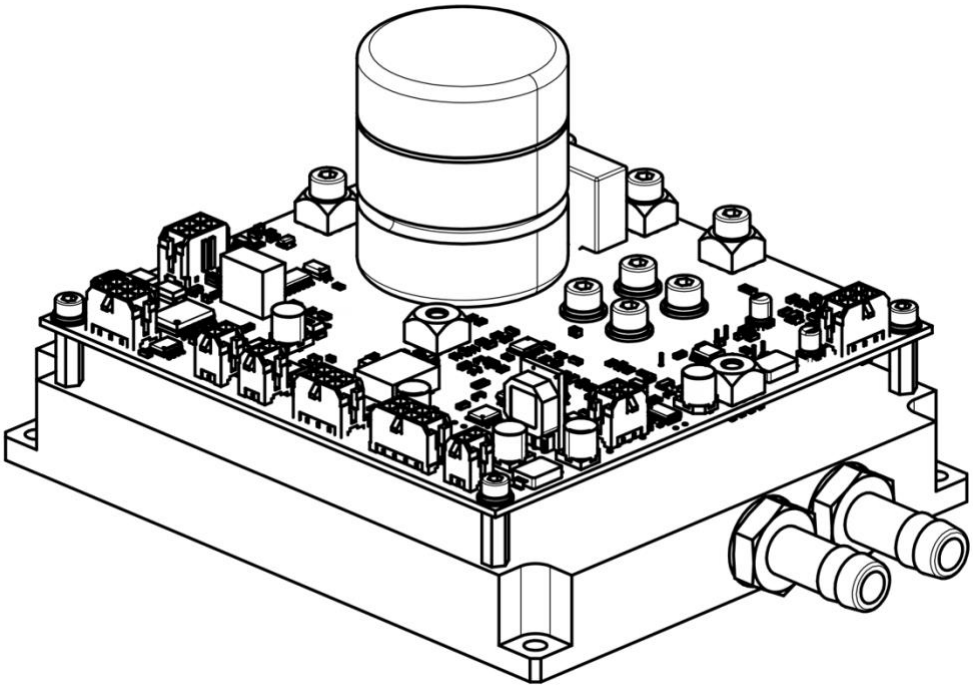
rev 1.04 / 2026 07 27

SDC-400-series diode driver

User manual



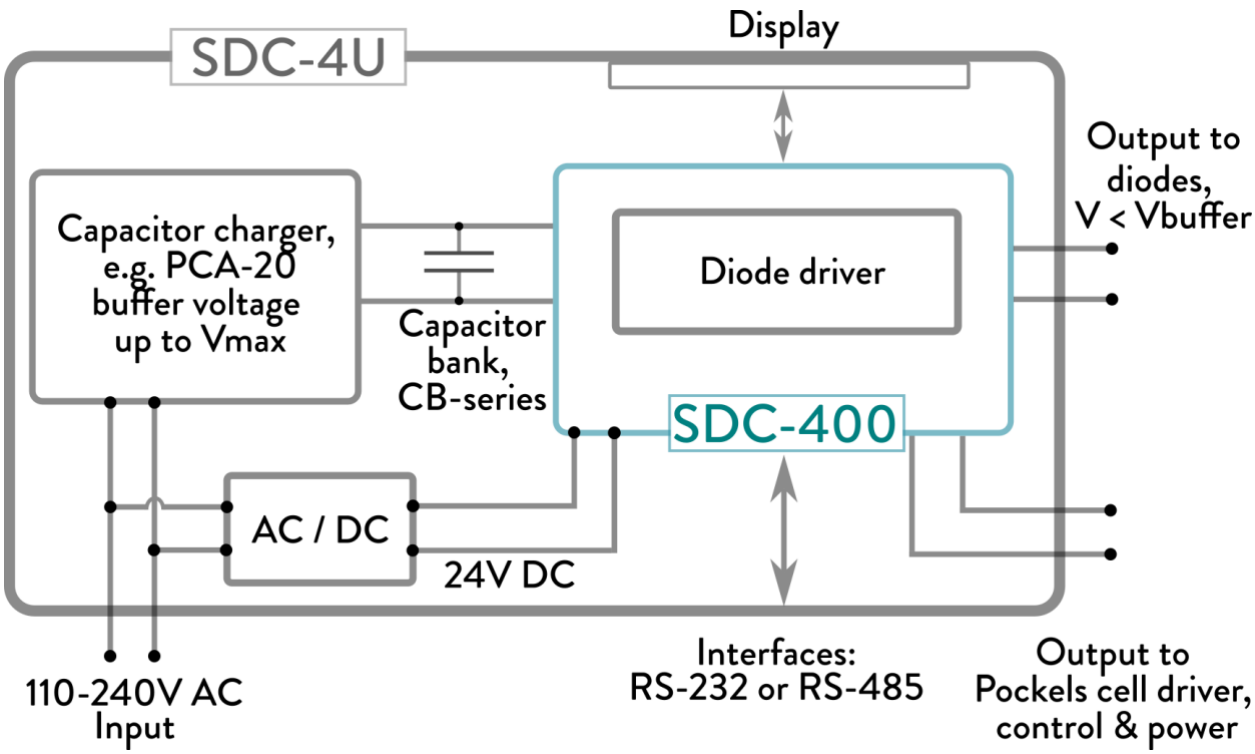
Warning! This equipment can be dangerous.
Please read this entire user manual carefully before operating the product.

Table of contents

Overview / Appearance

The driver is supplied as an OEM module and includes only the diode driver itself. All other system components, including but not limited to the AC/DC power supply, capacitor bank (if required), and graphical user interface (GUI), must be purchased separately, either by OEM Tech or by third-party suppliers.

As an example, the diagram below illustrates how the laboratory 19-inch rack-mounted SDC-4U driver is built around the SDC-400 high-voltage module with forced-air cooling.



The SDC-400 is available in the following major versions:

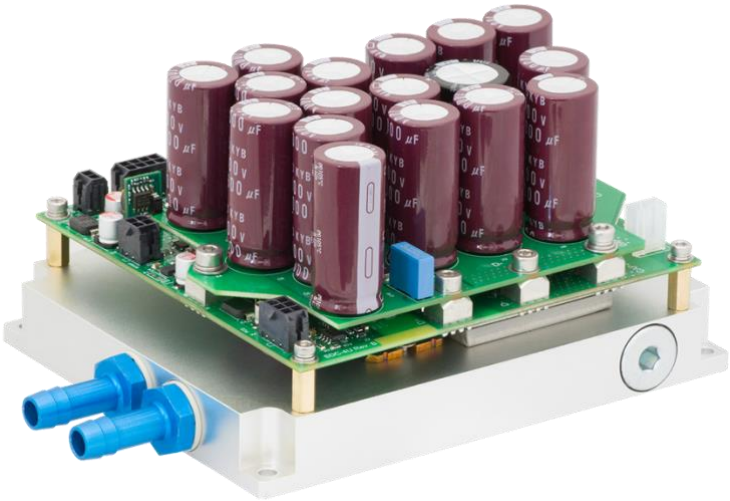
- High-voltage version with forced-air cooling
- High-voltage version with water cooling
- Low-voltage version with forced-air cooling
- Low-voltage version with water cooling

See also the photographs on the next page.

All key operating parameters of the SDC-400 laser diode driver, including output current, pulse width, pulse repetition rate, and other settings, can be configured from a computer or other control device via the RS-485 or RS-232 interface.

HIGH-VOLTAGE VERSION WITH FORCED-AIR COOLING

LOW-VOLTAGE VERSION WITH WATER COOLING



Main features of the SDC-400 drivers are given below.

HIGH-VOLTAGE VERSION

- Power input – external HV source (required, e.g. a PCA-series capacitor charging power supply from OEM Tech).
- LV input – external 24VDC source (required).
- Buffer capacitor bank – external capacitor bank (required, e.g. a CB-series capacitor bank from OEM Tech).
- Quick-discharge resistors – external, optional, can be controlled by SDC-400.
- Output current – up to 400A (*).
- Output voltage – up to 500V (*).
- Pulse widths are typical for Nd:YAG pumping (50-300us, wider on request). Fast rise time (typically 20–30 µs) with an adjustable soft-start current ramp to current setpoint.
- Pulse repetition rate – up to 50Hz and more (see also *Modes of operations* section for details).
- Maximum average output power is 1500W.
- Control of an external Pockels cell driver (purchased separately and connected externally to the SDC-400 driver), synchronization features.
- Versions with water and forced-air cooling available.

(*) Not at the same time. See also *Modes of operations* section for details.

LOW-VOLTAGE VERSION

- Power input – external power source (required).
- LV input – external 24VDC source (required).
- Buffer capacitor bank – 100V/16mF embedded capacitor bank, no external capacitor bank is required.
- Quick-discharge resistors – external, optional, can be controlled by SDC-400.
- Output current – up to 400A.
- Output voltage – up to 100V.
- Pulse widths are typical for Nd:YAG pumping (50-300us, wider on request). Fast rise time (typically 20–30 µs) with an adjustable soft-start current ramp to current setpoint.
- Pulse repetition rate – up to 500Hz or higher (see also *Modes of operations* section for details).
- Maximum average output power is 1500W.
- Control of an external Pockels cell driver (purchased separately and connected to the SDC-400 driver from outside), synchronization features.

- Versions with water and forced-air cooling available.

Cooling

The driver can be supplied in two versions, one with forced-air cooling, the other with water cooling.

Customized heatsinks are possible on request.

Contents of delivery

By default, the delivery package contains the following parts:

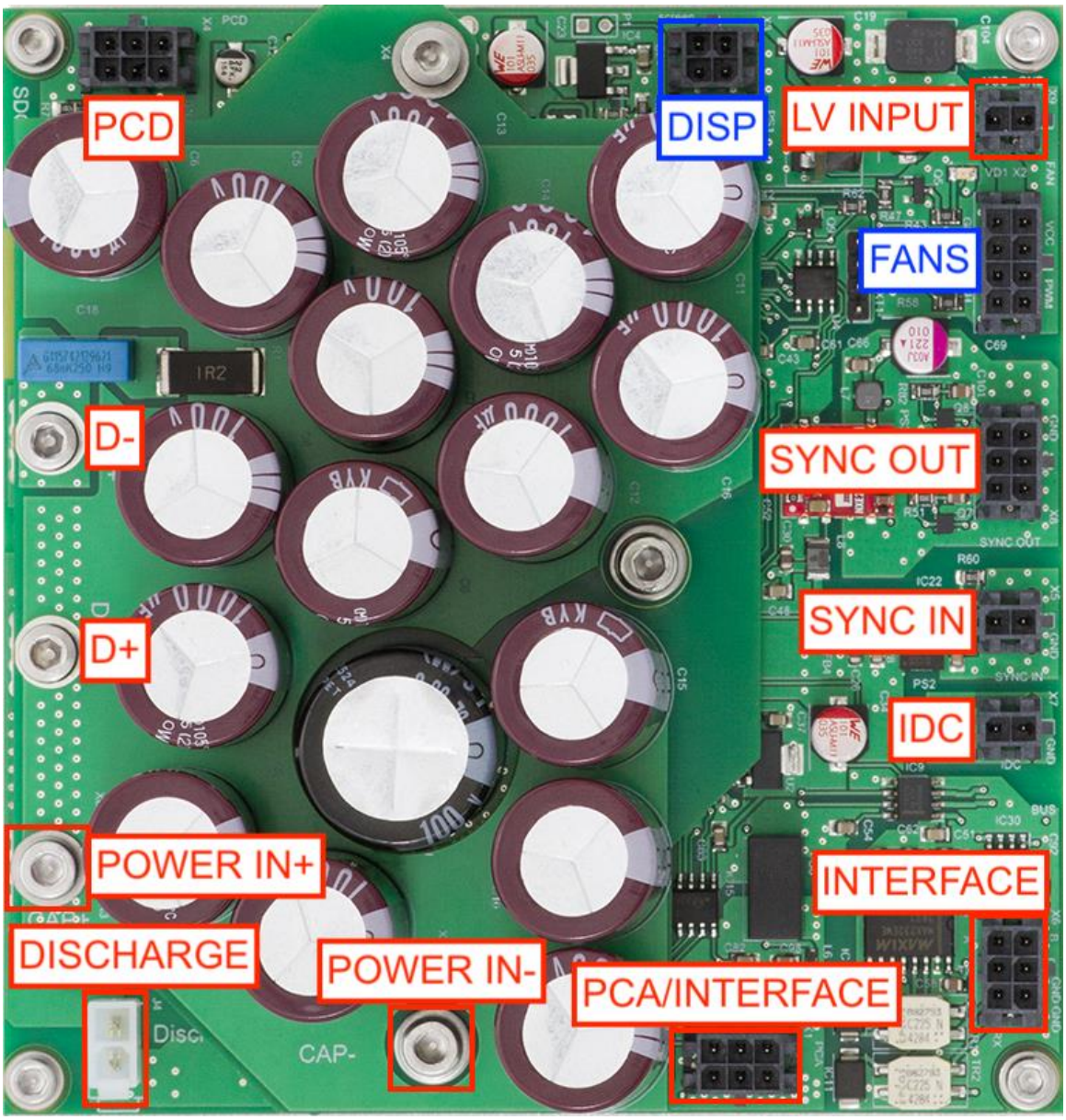
- SDC-400 diode driver – 1pc
- CAP or POWER IN mating cable (50cm length) – 2pcs
- LV INPUT mating cable (50cm length) – 1pc
- DIODE mating cable (50cm length) – 2pcs
- DISCHARGE mating cable (50cm length) – 1pc
- INTERFACE mating cable (50cm length) – 1pc
- SYNC IN mating cable (50cm length) – 1pc
- SYNC OUT mating cable (50cm length) – 1pc
- IDC mating cable (50cm length) – 1pc

The following cables are supplied optionally:

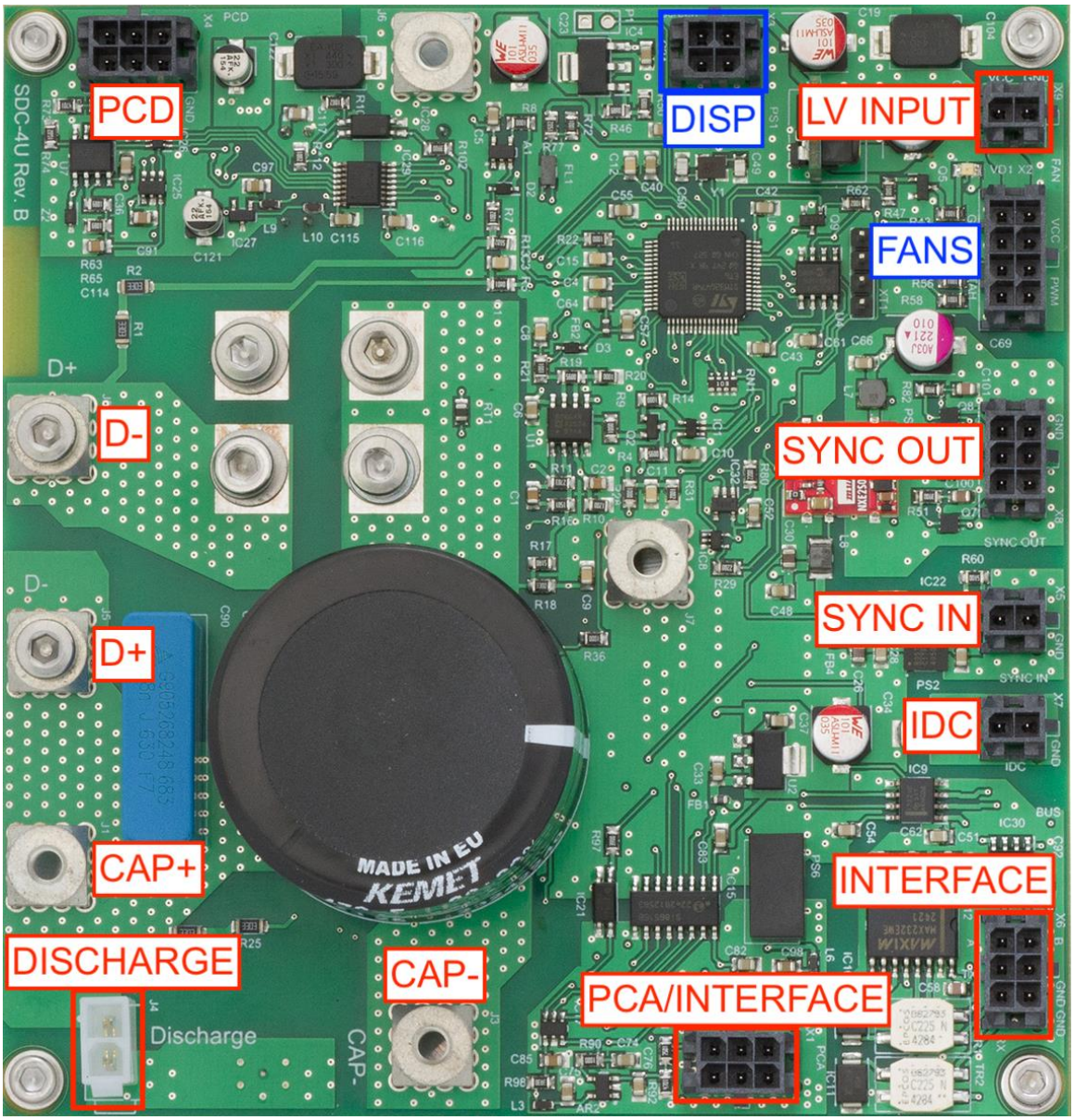
- PCA/INTERFACE mating cable (to a PCA-series capacitor charger, 50cm length) – 1pc
- PCD mating cable (to a Pockels cell driver, 50cm length) – 1pc

Connectors, pins, interface signals

LOW-VOLTAGE VERSION



HIGH-VOLTAGE VERSION



POWER IN / CAP:
M4 THREADED TERMINALS (2PCS)

PIN (COLOR)	DESIGNATION	DESCRIPTION
- (**red**)	POWER IN "+"	Power input to the driver of low-voltage version.
- (**black**)	POWER IN "–"	
- (**red**)	CAP "+"	Power input to the driver of high-voltage version.
- (**black**)	CAP "–"	

LV INPUT: 2-PIN MOLEX MICRO-FIT

24VDC power input to the driver.

PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**red**)	+24V	Input positive (+24VDC).
2 (**black**)	RETURN	Return from 24VDC power supply.

DIODE: M4 THREADED TERMINALS (2PCS)

PIN (COLOR)	DESIGNATION	DESCRIPTION
D+ (**red**)	DIODE "+"	Diode's anode.
D- (**black**)	DIODE "–"	Diode's cathode.

Important note

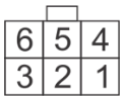
Since the diode driver has no galvanic isolation between input and output, the diode's anode will be at the buffer-voltage potential, and the diode's cathode will be at a floating potential different from ground.

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).

PCD: 6-PIN MOLEX MICRO-FIT

Pockels cell driver connection. Recommended drivers are QBD-series and QBU-series offered by OEM Tech. The signals are optically isolated from all other driver's circuits, but not from each other.



PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**black**)	PCD GND	Return of PCD circuits.
2 (**green**)	PCD Enable	Enable signal to the Pockels cell driver.
3 (**violet**)	HV Monitor	HV Monitor signal from the Pockels cell driver.
4 (**red**)	+24VDC	Power to the Pockels cell driver.
5 (**blue**)	Pulse	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.

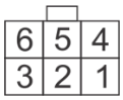
SYNC IN: 2-PIN MOLEX MICRO-FIT

Synchro input signal to the driver. The signal is optically isolated.

PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**transparent**)	SYNC IN	Synchro input (~500 Ohm input impedance, amplitude 3-5V TTL, pulse width >1us).
2 (**white**)	SYNC IN GND	Return of the Synchro input signal.

SYNC OUT: 6-PIN MOLEX MICRO-FIT

Synchro output signals from the driver. Synchro output signals are optically isolated from all other driver's circuits, but not from each other.



PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**orange**)	SYNC OUT 1	Synchro output (50 Ohm impedance, amplitude 5V, duration is 5us fixed). Synchro output pulses are shifted relative to the trailing edge of the TTL pulse applied to the diode driver of SDC-400 by the specified delay. The delay can be positive or negative.
2 (**yellow**)	SYNC OUT 2	Synchro output (50 Ohm impedance, amplitude 5V, coincides with IGBT pulse).
3 (**green**)	SYNC OUT 3	Synchro output (50 Ohm impedance, amplitude 5V, coincides with PCD pulse).
4, 5, 6 (**black**)	SYNC OUT GND	Return of all Synchro output signals.

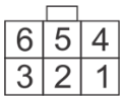
IDC: 2-PIN MOLEX MICRO-FIT

Door-interlock connection to the driver. The signal is optically isolated.

PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**transparent**)	IDC	Door-interlock connection.
2 (**green**)	IDC GND	Return of the IDC signal.

INTERFACE: 6-PIN MOLEX MICRO-FIT

RS-485 and RS-232 interfaces. Both interfaces are optically isolated from all other driver's circuits, but not from each other.

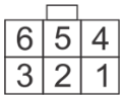


PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**blue**)	RS-232 RX	RS-232 interface of SDC-400.
2 (**orange**)	RS-232 TX	RS-232 interface of SDC-400.
3 (**green**)	RS-485 A	RS-485 interface of SDC-400.
4 (**black**)	RS GND	Return of RS-232 and RS-485 interfaces.
5 (**black**)	RS GND	Return of RS-232 and RS-485 interfaces.
6 (**violet**)	RS-485 B	RS-485 interface of SDC-400.

Note: For better performance, we recommend not using RS-232 and RS-485 interfaces simultaneously.

PCA/INTERFACE: 6-PIN MOLEX MICRO-FIT

Control of the PCA-series capacitor charging power supply if it's used as a power source for the SDC-400. The signals are optically isolated from all other driver's circuits, but not from each other.



PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**black**)	PCA GND	Return of PCA/INTERFACE circuits.
2 (**blue**)	Inhibit	Inhibit signal to the PCA.
3 (**violet**)	Voltage Monitor	Voltage Monitor signal from the PCA.
4 (**green**)	Ready	Ready signal from the PCA.
5 (**white**)	Fault	Fault signal from the PCA.
6 (**yellow**)	Voltage Program	Voltage Program signal to the PCA.

DISCHARGE: 2-PIN MOLEX MINI-FIT

Optional connection of the quick-discharge safety resistors.

PIN (COLOR)	DESIGNATION	DESCRIPTION
1 (**black**)	Discharge	Connection of the quick-discharge resistors. The maximum discharge current allowed for this circuit is 1A. Discharge pin is always under CAP "+" / POWER IN "+" potential.
2 (**black**)	Discharge return	Once discharge is on, Discharge return pin is forcibly connected to CAP "–" / POWER IN "–".

GROUNDING

Grounding policy

Most of the SDC-400 circuits (DIODE, POWER IN/CAP, LV INPUT, DISCHARGE) have common ground. PCD, SYNC IN, SYNC OUT, INTERFACE, PCA/INTERFACE, and IDC are galvanically isolated from each other and from power circuits as well.

Safety

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 the 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

- If high-power operation is expected, install the SDC-400 on an appropriate heatsink or cold plate.
- Connect your diode to the driver's diode D+ and D– connectors.
- **Ensure that neither the diode's positive (anode) nor the diode's negative (cathode) is grounded in any way.**
- If necessary, connect your Pockels cell driver to the driver's PCD connector.
- Organize your door-interlock connection (IDC connector of the driver). Ensure that IDC circuit is "closed" when you start the operations.
- Connect the driver to the PC or other controlling device via RS-232 or RS-485 interface (INTERFACE connector of the driver).
- If synchronization is required, connect the SDC-400 with other equipment using the synchro input and synchro output signals (SYNC IN and SYNC OUT connectors of the driver).
- Connect the driver to the power source using LV INPUT connector (power shouldn't be applied to the driver yet).

Operations

- Assemble your setup following the *Installation* section, now your driver is ready for operation.
- Apply 24VDC power to the driver.
- Run demo software supplied together with the driver.
- Operate the driver according to the software documentation (*Appendix 2*).
- Remove 24VDC power from the driver.

Faults

The driver raises faults in the cases listed below.
Some of them stop operation, while others do not.

#	FAULT	DESCRIPTION / COMMENTS
1	OVERHEAT1	SDC-400 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.
9	OVERHEAT2	SDC-400 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.

Technical notes

OUTPUT CABLES

The output cables inductance affects the SDC-400 performance. The higher the cable inductance, the greater the current overshoot. 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-400 allows to adjust the output current rise time to suppress the current overshoot when 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.

Modes of operations

The customer can themselves configure the high-voltage version of the SDC-400 for different modes of operations. The available operating modes and the parameters they affect are listed below. The operating parameters of the low-voltage version of the SDC-400 are given for comparison in the same table.

PARAMETER	VALUE (*)					
	SDC-400-HV					SDC-400-LV
	300V mode	350V mode	400V mode	450V mode	500V mode	N/A
Maximum input voltage (V_{MAX})	300V	350V	400V	450V	500V	100V
Maximum output voltage (**)	<300V	<350V	<400V	<450V	<500V	<100V
Recommended external capacitor bank capacitance	>15mF @ 300V	>15mF @ 350V	>10mF @ 400V	>8mF @ 450V	>5mF @ 500V	Not required
Diode driver:						
Maximum output current (I_{MAX})	400A	350A	300A	250A	225A	400A
Recommended diode voltage @ I_{MAX}, 250us (**)	<265V	<320V	<370V	<420V	<470V	<65V
Pulse width (T_{MIN}… T_{MAX})	50us…300us					50us…300us
Pulse repetition rate	0Hz…50Hz					0Hz…500Hz
Output limitations:						
Energy limit	I_{MAX}*V_{MAX}*T_{MAX}					I_{MAX}*V_{MAX}*T_{MAX}
Power limit	1500W					1500W
Guaranteed regime	400A/265V/ 250us/50Hz	350A/320V/ 250us/50Hz	300A/370V/ 250us/50Hz	250A/420V/ 250us/50Hz	225A/470V/ 250us/50Hz	400A/65V/ 250us/200Hz

(*) Customizations (e.g. non-standard output currents, non-standard diode voltages, pulse widths, pulse repetition rates, software customizations, and others) are possible on request. Please contact the manufacturer for the details.

(**) Nominal maximum output voltage is equal to the maximum input voltage V_{MAX}. Actual output voltage applied to the diodes is several volts lower than the input voltage due to voltage drops across internal components and wiring.

Specifications

ELECTRICAL

Inputs:	
Power input	Voltage source with the adjustable DC output voltage is recommended for most of applications. Output power must be matched with the required operating regimes. SDC-400 can control PCA-series capacitor charging power supplies by OEM Tech, though third-party sources of the input voltage can be used as well.
Maximum input voltage (V_{MAX})	500V for high-voltage version 100V for low-voltage version Other on request
LV input	24VDC, 2A max
Output:	
Regime of operations	Pulsed
Maximum output voltage	Nominal maximum output voltage is equal to the maximum input voltage V_{MAX}, i.e.: • 500V for high-voltage version • 100V for low-voltage version • Other on request Actual output voltage applied to the diodes is several volts lower than the input voltage due to voltage drops across internal components and wiring.
Maximum output current (I_{MAX})	400A, other on request
Output current	Adjustable from approx. 10% of I_{MAX} to 100% of I_{MAX}, other on request
Pulse width	Adjustable in 50...T_{MAX} range, T_{MAX} is 300us by default, other on request
Maximum pulse repetition rate	50Hz for high-voltage version 500Hz for low-voltage version Other on request
Peak power	>100kW for high-voltage version 40kW for low-voltage version

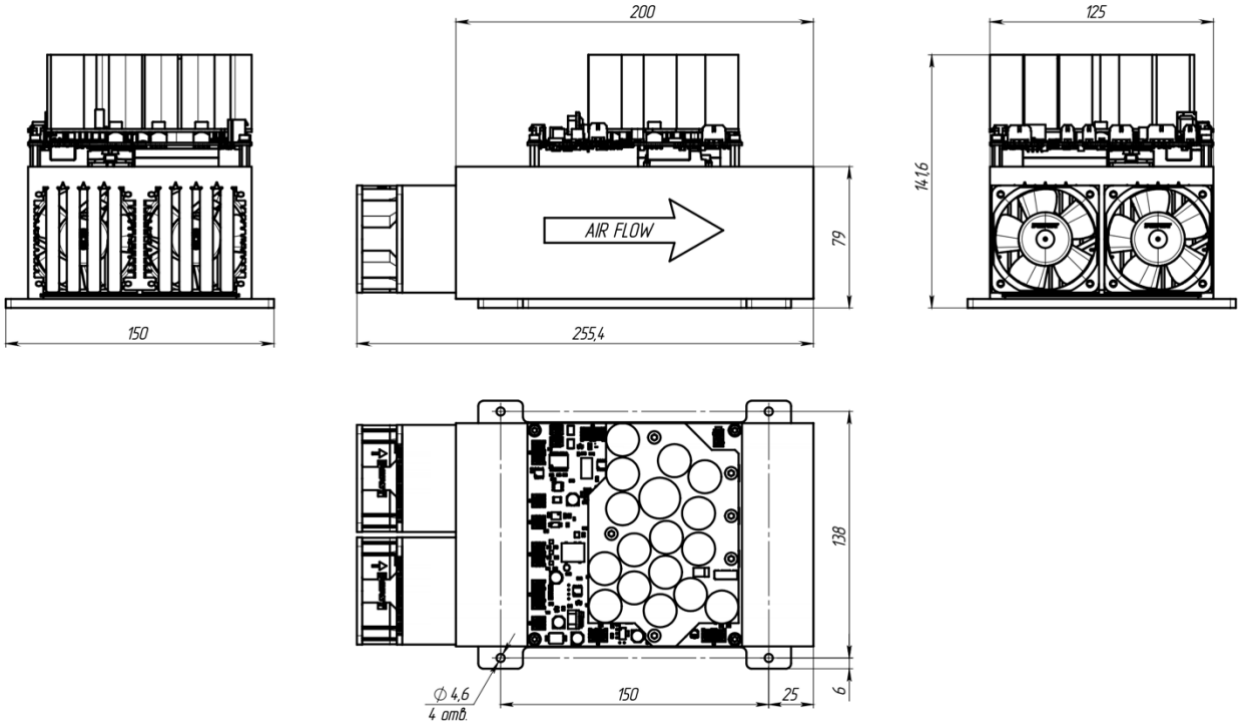
	Other on request
Maximum average output power	1500W, other on request
Rise time	<20-30us typically, slow start adjustable in 0…50us range
Bias current	+, model dependent (<50mA)
Recommended cables:	
For diode connections	Inductance – <500nH Cross-section – 4mm^2 Length – <50cm (up to 2m acceptable)
For external capacitor bank connections (high-voltage version)	Cross-section – 4mm^2 Length – <50cm
Interfaces:	
RS-485 RS-232	+ +
Protections / safety:	From overcurrent From overheating From incorrect input voltage From too high frequency of synchronization pulses Door-interlock connection Quick-discharge resistors connection
Cooling:	Two options are available: - Forced-air cooling - Water cooling
Other:	
Synchro input	+, 1pc
Synchro output	+, 3pcs
Pockels cell driver control	+ (The Pockels cell driver needs to be purchased separately, placed outside and connected with a cable)
Environmental:	
Operating temperature	+10 … +40 °C
Storage temperature	-20 … +60 °C
Humidity	<90%, non-condensing

MECHANICAL

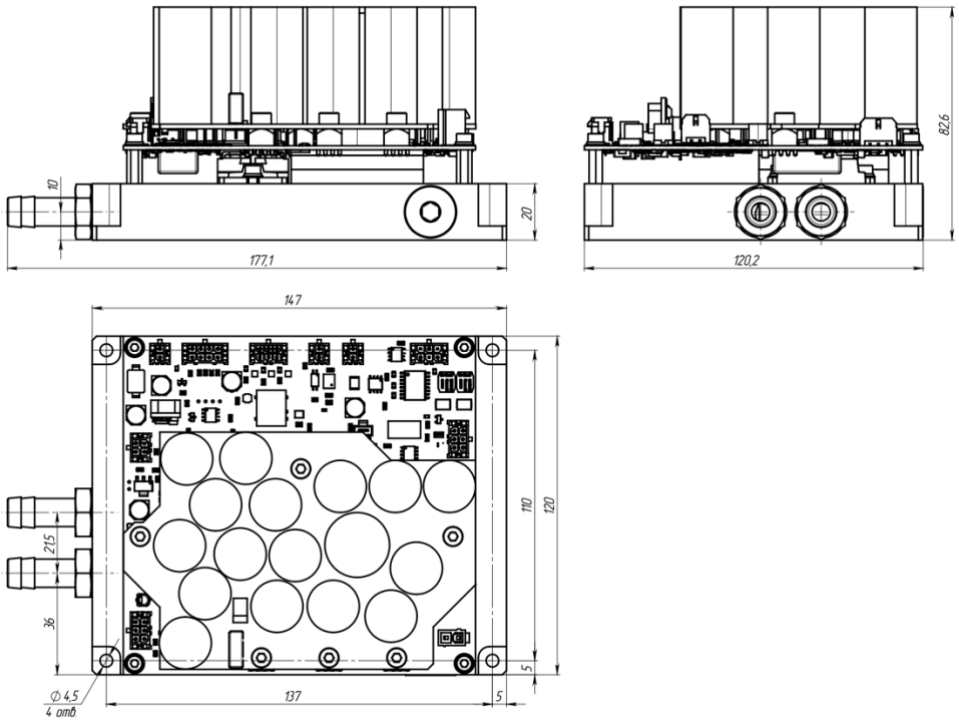
Size (WxDxH)	See the dimensional drawings below
Weight	<1.5kg / <3.5kg for water and forced-air cooled versions respectively

Dimensional drawings

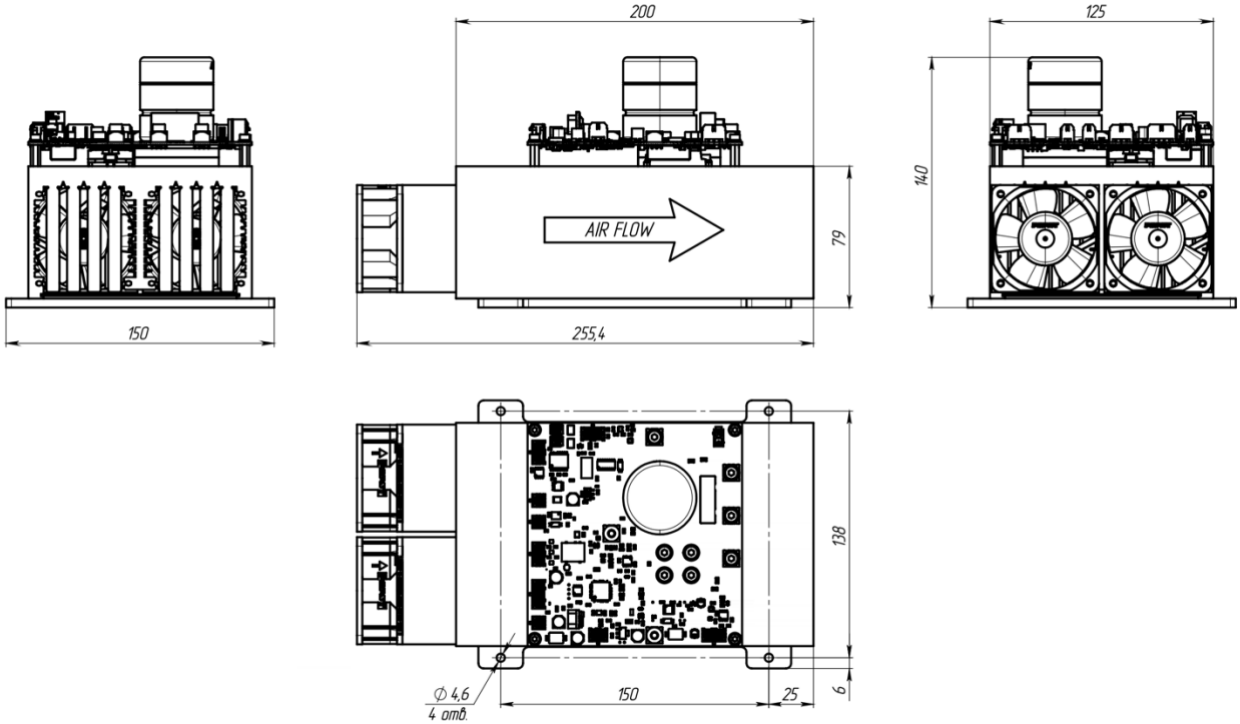
LOW-VOLTAGE VERSION (AIR)



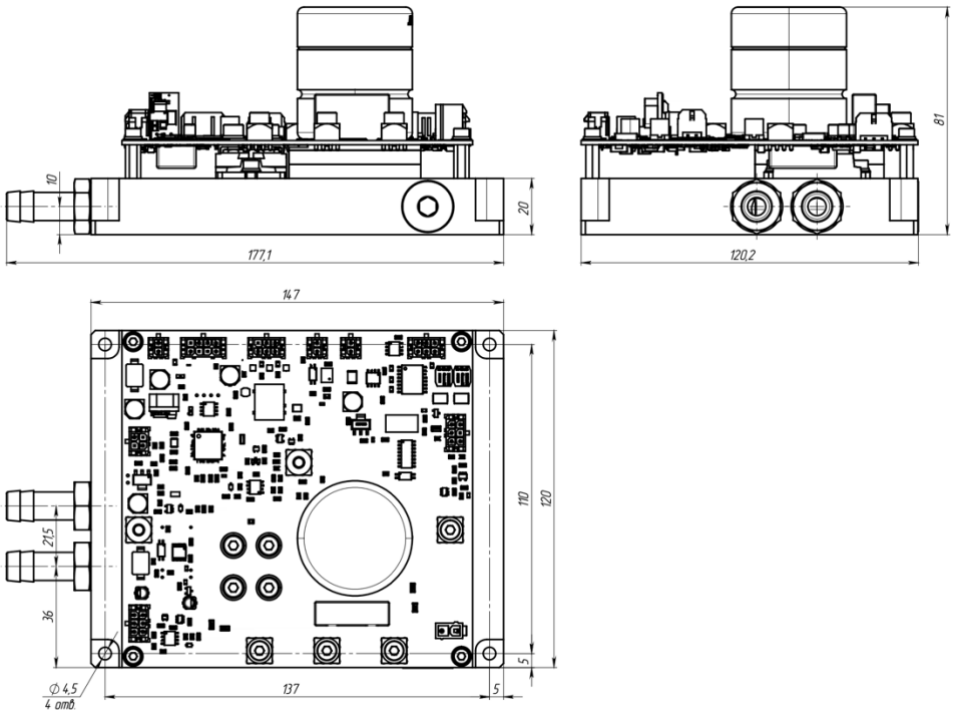
LOW-VOLTAGE VERSION (WATER)



HIGH-VOLTAGE VERSION (AIR)



HIGH-VOLTAGE VERSION (WATER)



How to order?

SDC-400-XX-Y, where:

- XX code defines the voltage version of the driver, it can be either HV (high-voltage version of the driver) or LV (low-voltage version of the driver).
- Y code defines the cooling type, it can be either A (air-cooled version) or W (water-cooled version).

Some examples of typical configurations are given in the table below:

PART NUMBER	DESCRIPTION
SDC-400-HV-A	Maximum output voltage – 500V (*) Maximum output current – 400A (*) Embedded capacitor bank – none Maximum output power – 1500W Forced-air cooling (*) not at the same time, see also *Modes of operations* section
SDC-400-LV-W	Maximum output voltage – 100V Maximum output current – 400A Embedded capacitor bank – 100V/16mF Maximum output power – 1500W Water cooling

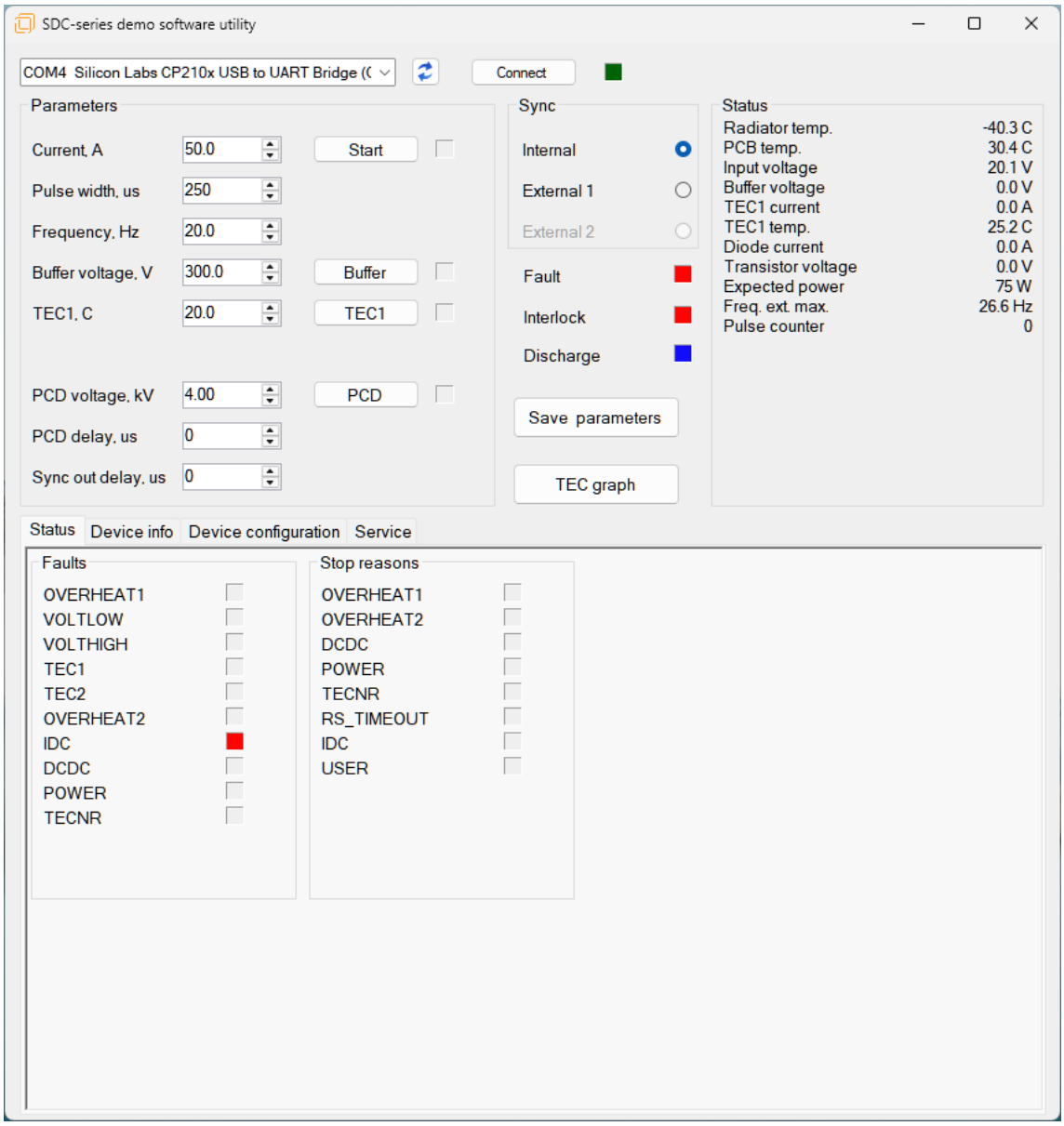
Other modifications are available on request.

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-400 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-400-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: 19’’ rack-mounted version

A 19’’ rack-mounted version (with enclosure and graphic UI) for easy and unattended laboratory use is also available. Please see description of SDC-4U diode drivers for the details.