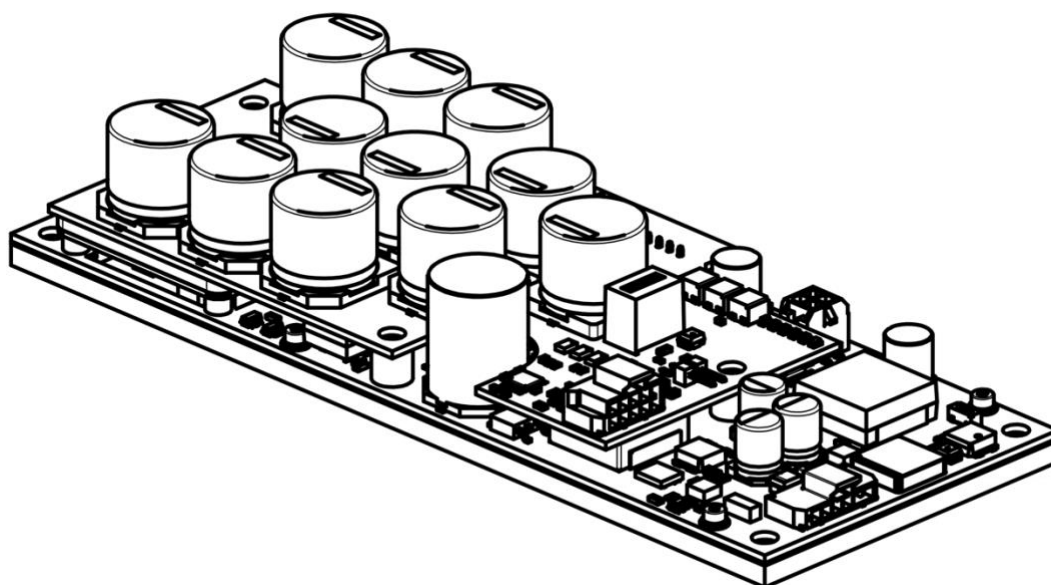


SDC-150-series diode drivers

User manual



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

Important note. Please measure the output with an adequate load only (diodes).
A resistive load connected to the output will not destroy the driver but will severely distort its behavior.



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Overview / Appearance

SDC-150 is a series of “all-in-one” DPSS Nd:YAG controllers, which include a pulsed current source to drive pump diodes, TEC controller for their thermal stabilization and embedded Pockels cell driver for generation of Q-switched pulses.

Driver's input is 28VDC (+/-7V).

Driver's major features are:

- Very compact dimensions – from ~180x70x30mm to ~180x70x35mm
- 28VDC (+/-7V) input
- Diode output – up to 350A in high-current versions, up to 160V in high-voltage versions, up to 300us, up to 30Hz (20-25kW peak, 20-40W average max) *
- TEC output – up to 5A, ~20V (50W max) *
- Pockels cell driver – SDC-150 can be equipped with Pockels cell driver of different modifications on customer's choice, say, for DKDP cells, for LiNbO₃ cells and so on

(*) *Other parameters are available on request. See also [How to order?](#) section.*



The base interface is the RS-232 (the RS-485 on request, simple PC software is supplied together with the controller). Stand-alone operations are available “from the box”.

Cooling

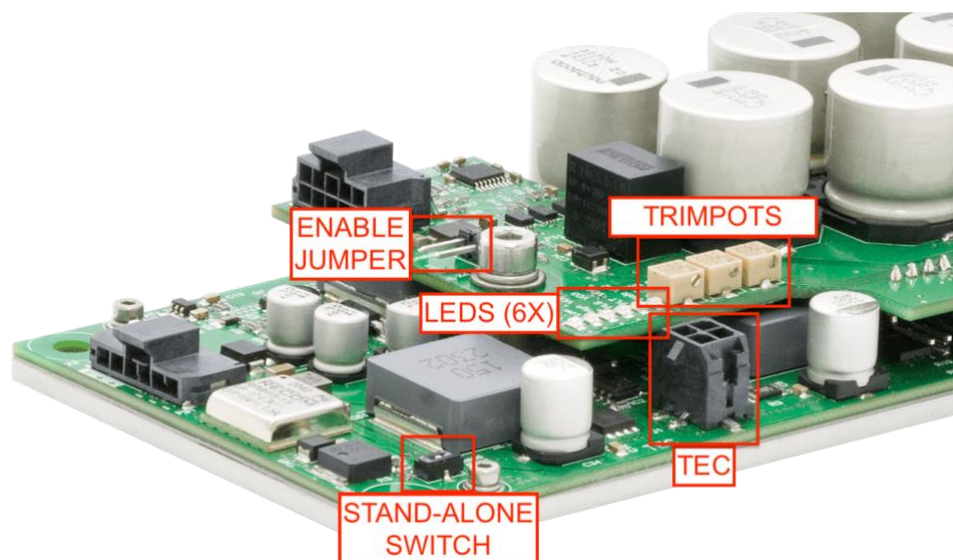
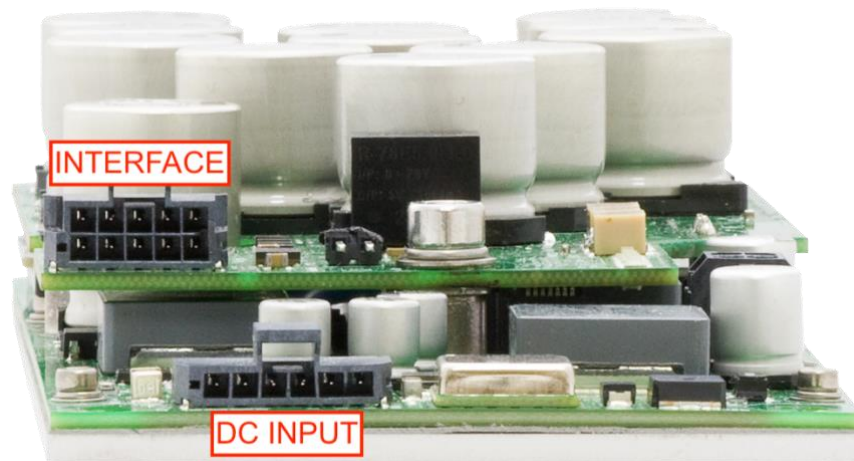
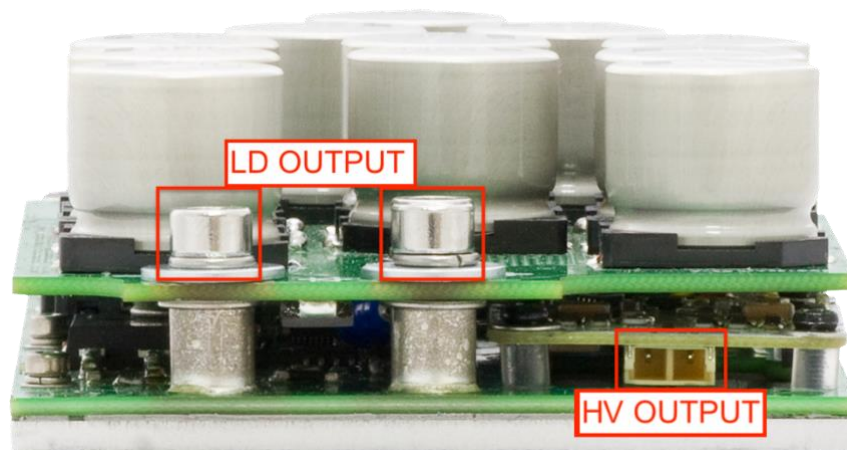
The SDC-150 driver includes an aluminum heat-dissipation base plate, which by itself is not sufficient to cool the module. The driver is intended to be passively cooled by mounting its bottom surface onto the customer’s external cold plate or heatsink. The customer’s responsibility is to keep the plate temperature below 70 °C.

Contents of delivery

By default, the delivery package contains the following parts:

- SDC-150 diode driver – 1pc
- DC INPUT mating cable (50cm length) – 1pc
- INTERFACE mating cable (50cm length) – 1pc
- TEC mating cable (40cm length) – 1pc
- HV OUTPUT mating cable (15cm length) – 1pc
- USB/RS-232 adapter – 1pc
- USB flash drive with PC software – 1pc

Connections, signals, signal descriptions



TYPE	DESIGNATION	DESCRIPTION
Connector	DC INPUT	Power input (28VDC nominal)
Connector	INTERFACE	RS-232 interface (RS-485 on request) Synchro inputs, synchro output, other signals
Screw terminals	LD OUTPUT	Pulsed output to the laser diode
Connector	TEC	Peltier connection
Connector	HV OUTPUT	Pockels cell connection (high voltage output of SDC-150)
Slide switch	STAND-ALONE SLIDE SWITCH	Defines the way output current and diode temperature are set (manually via onboard trimpots when the switch is ON position, or by interface signals from a controlling device when the switch is in OFF position)
Trimpot	VOLTAGE TRIMPOT	Sets buffer voltage if <i>STAND-ALONE SWITCH</i> is on
Trimpot	CURRENT TRIMPOT	Sets output current if <i>STAND-ALONE SWITCH</i> is on
Trimpot	TEMP TRIMPOT	Sets diode temperature if <i>STAND-ALONE SWITCH</i> is on
Jumper	ENABLE JUMPER	Enables driver's outputs in Stand-alone mode of operations
LED	STATUS LEDS	A number of LEDs indicating the driver's status

DC INPUT: 6-PIN MOLEX NANO-FIT (1054301106)



Input supply voltage (28VDC nominal) is to be connected here.

PIN (color)	DESIGNATION	DESCRIPTION
1, 2, 3 (black)	GND	Input supply voltage (28VDC +/- 7V) is to be connected here.
4, 5, 6 (red)	V _{IN}	

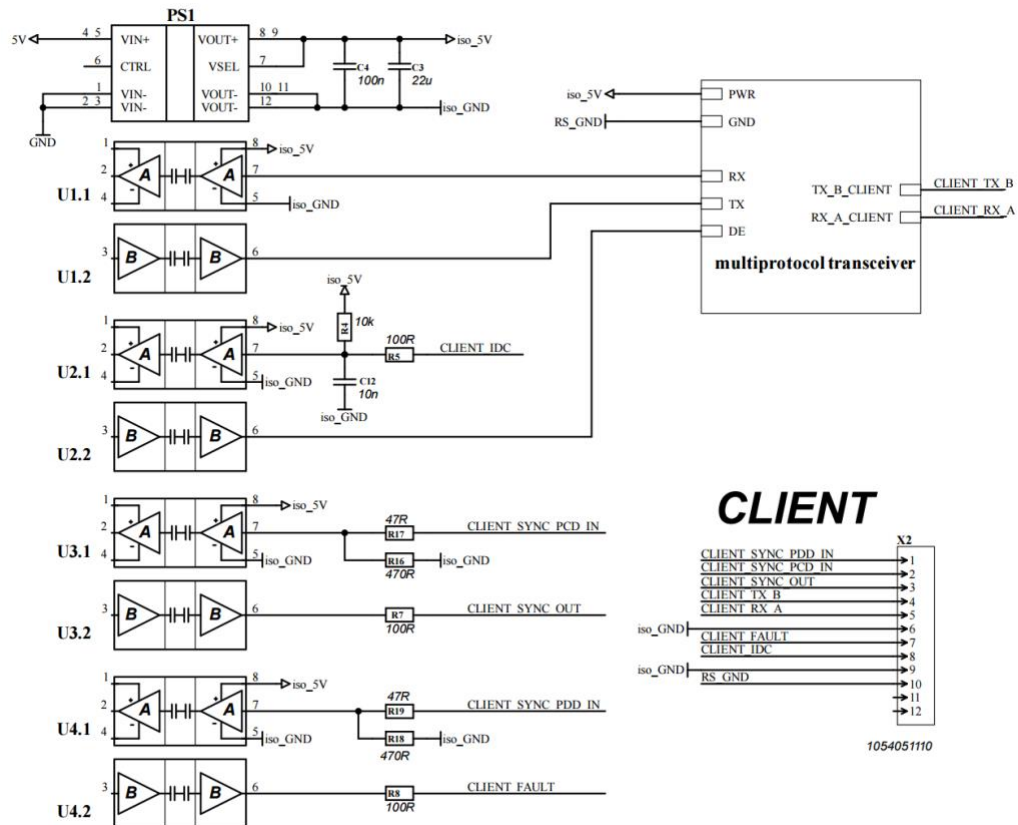
INTERFACE: 10-PIN MOLEX NANO-FIT (1054051110)



INTERFACE connector provides both digital and analogue interfaces to the driver.

PIN (color)	DESIGNATION	DESCRIPTION
1 (white)	Synchro IN (LD)	Incoming synchronization pulses for triggering the current pulses to the diode should be applied to this pin when the module is operating in external synchronization mode. 5V TTL, input impedance is approx. 470 Ohm
2 (brown)	Synchro IN (PCD)	Incoming synchronization pulses for triggering the Pockels cell driver should be applied to this pin when the module is operating in external synchronization mode. 5V TTL, input impedance is approx. 470 Ohm
3 (yellow)	Synchro OUT	Synchro output signal (1ms pulse length, adjustable delay relatively to the current pulse)
4 (violet)	RS-232 TX	The control device connection (RS-232 interface).
5 (orange)	RS-232 RX	
10 (blue)	RS-232 GND	
7 (red)	Fault	Module internal failure indication. The module raises Fault in the following cases: - Overheating - Unable to charge buffer capacitors - Unable to stabilize the temperature - Other failures
8 (green)	IDC	Door-interlock connection. Should be pulled to the ground to allow the operations.
6, 9 (black)	Interface Return	Common return of all interface circuits

INTERFACE CIRCUITS SCHEMATICS



LD OUTPUT: M4 THREAD (2PCS)

Output to the laser diode.

TEC: 4-PIN MOLEX MICRO-FIT (430450418)



Peltier and NTC connection.

PIN (color)	DESIGNATION	DESCRIPTION
1 (red)	TEC+	Peltier connection (positive).
2, 4 (blue)	NTC	NTC connection (10kOhm).
3 (black)	TEC-	Peltier connection (negative).

HV OUTPUT: PROPRIETARY CONNECTOR BY OEM TECH

The Pockels cell is to be connected here.

Red wire – HV output positive

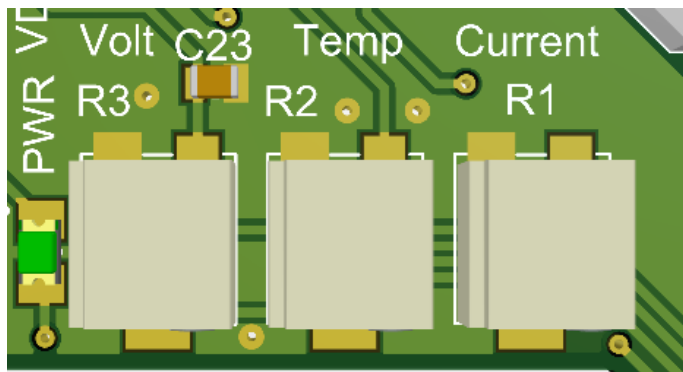
Red wire – HV output negative

JUMPERS, SWITCHES, TRIMPOTS, LEDS

STAND-ALONE SLIDE SWITCH. When the *STAND-ALONE SWITCH* is ON (stand-alone position), the SDC-150 does not require an active RS-232 connection to operate and functions as a stand-alone device. In this case, the output parameters are set either from memory or by the *VOLTAGE TRIMPOT*, *CURRENT TRIMPOT*, and *TEMP TRIMPOT* (see also [Modes of operations](#) section). When the *STAND-ALONE SWITCH* is OFF (RS position), the SDC-150 requires an active RS-232 connection and must receive all control commands via the RS-232 interface.

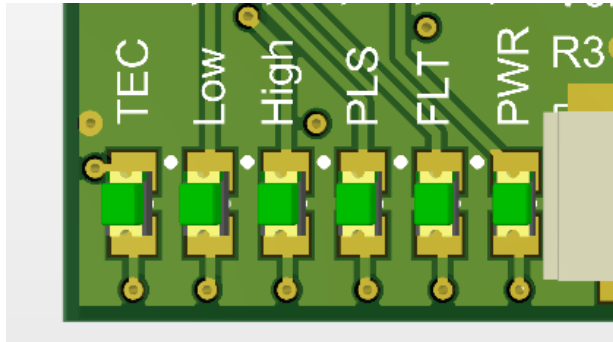
VOLTAGE TRIMPOT, CURRENT TRIMPOT, TEMP TRIMPOT.

When the *STAND-ALONE SWITCH* is ON and the parameters are set according to the trimpots (see also software description), the *VOLTAGE TRIMPOT* (R3) defines the buffer voltage, the *CURRENT TRIMPOT* (R1) defines the output pulse current and the *TEMP TRIMPOT* (R2) defines the TEC set point.



ENABLE JUMPER. Enables all driver outputs in Stand-alone mode of operations.

STATUS LEDs. There are several LEDs indicating the state of the SDC-150 board.



PWR (green):

- lights steadily once DC power is applied to the driver

FLT (red):

- lights steadily when any Fault condition is detected

PLS (blue):

- blinks synchronously with LD pulses

High (red):

- blinks when buffer voltage is too high (Voltage High warning)

Low (blue):

- blinks when buffer voltage is too low (Voltage Low warning)

TEC (green):

- lights steadily if the “run with TEC stabilization” parameter is NOT selected
- if the “run with TEC stabilization” parameter is selected, then TEC LED:
 - does not light when the TEC is turned off
 - blinks when the TEC is on, but thermal stabilization is not yet achieved
 - lights steadily when the TEC is on, and thermal stabilization is achieved

MOUNTING AND GROUNDING

Driver should be mounted using four M4 screws.

Grounding policy

Most of the SDC-150 circuits share a common ground. Only the INTERFACE signals (both digital and analogue) are galvanically isolated from other circuits.

Important note

Since the diode driver has no galvanic isolation between the 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.

Both the anode and the cathode must not be grounded in any manner and must be isolated from ground.

Modes of operations

RS-232 MODE AND STAND-ALONE MODE

SDC-150 has two control modes – RS-232 mode и Stand-alone mode:

- RS-232 mode – requires an active RS-232 connection, and all control controls are performed via commands sent through the RS-232 interface. To operate in this mode, the *STAND-ALONE SWITCH* must be set to the OFF position.
- Stand-alone mode – does not require an active RS-232 connection, and the SDC-150 begins operating immediately after DC power is applied to the board. To operate in this mode, the *STAND-ALONE SWITCH* must be set to the ON position.

Switching between RS-232 mode and Stand-alone mode is not trivial. Please follow the instructions below.

RS-232 MODE TO STAND-ALONE MODE

1. Make sure the driver power is off, and the *STAND-ALONE SWITCH* is in the OFF position.
2. Apply power to the SDC-150.
3. Establish an RS-232 connection between the controlling device and the SDC-150. The following description assumes that the SDC-150 is connected to a PC and controlled via the software; however, the same actions can be performed from the customer's control device by sending the appropriate RS-232 commands.

4. Select (tick) the “**Parameters from memory**” option in the software and configure the essential parameters and operating modes of the SDC-150, e.g. TEC temperature, output current, pulse width etc.
5. Save the parameters to the device’s EEPROM using the **Save parameters** button.
6. Remove power from the SDC-150.
7. Set the *STAND-ALONE SWITCH* to the ON position.
8. Apply power to the SDC-150.
9. Set ON the *ENABLE JUMPER* – driver will operate with saved parameters.

STAND-ALONE MODE TO RS-232 MODE

1. Remove power from the SDC-150 board.
2. Set the *STAND-ALONE SWITCH* to the OFF position.
3. Connect the SDC-150 to the controlling device (PC or another controller).
4. Apply power to the SDC-150.
5. Establish an RS-232 connection between the controlling device and the SDC-150.

Specifications

ELECTRICAL

DC INPUT:	
Input voltage (V_{IN})	28VDC +/- 7V
Current consumption	10A max.
OUTPUT 1 (DIODE DRIVER):	
Description	Pulses delivered to the pump diode
Load	Laser diode
Maximum buffer voltage (V_{MAX})	Model dependent (user selectable up to 160V), other on request
Maximum output voltage	Model dependent (see also How to order? section), other on request
Maximum output current (I_{MAX} or I_{250})	Model dependent (user selectable up to 350A), other on request I_{MAX} is fully achievable at pulse widths up to 250us, and is derated at longer pulses
Maximum peak power ($I_{MAX} * V_{MAX}$)	Model dependent, usually in the 20-25kW range
Output current (I)	Adjustable from approx. 10% of I_{MAX} to 100% of I_{MAX} , other on request
Buffer voltage (V)	Adjustable in $V_{IN}...V_{MAX}$ range, other on request
Accuracy	<1% of I_{MAX}
Pulse width (t)	Adjustable from 50us to 300us (T_{MAX}), other on request
Pulse rise time	<20-30us typically, slow start adjustable in 0...50us range
Repetition rate (f)	Adjustable up to 30Hz, other on request
Maximum average output power ($V*I*t*f$)	50W, other on request
Target regime	To be specified for exact version (see also How to order? section)
Important note – since the diode driver has no galvanic isolation between the input and output: the diode's anode will be at the buffer-voltage potential	

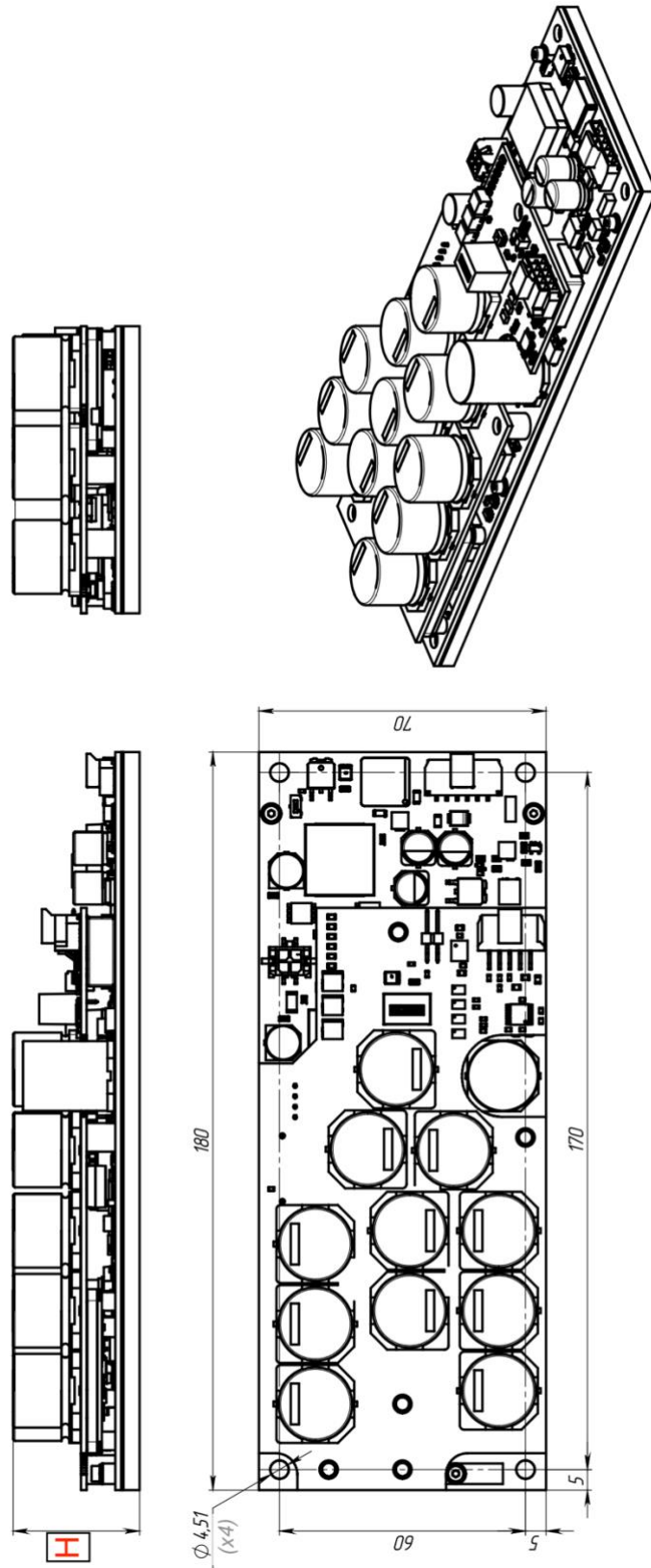
- the diode's cathode will be at a floating potential different from ground both the anode and the cathode must not be grounded in any manner and must be isolated from ground	
OUTPUT 2 (TEC):	
Load	Peltiers
Maximum output current	5A (other on request)
Maximum output voltage	V _{IN} -4V (other on request)
Stabilization temperature	+20...+60 °C adjustable (other on request)
Accuracy	0.1 °C
Thermistor	10kOhm NTC
OUTPUT 3 (POCKELS CELL DRIVER):	
Description	By default, SDC-150 is equipped with QBD-nano-3801 Pockels cell driver. Other drivers can be installed on request.
Load	DKDP Pockels cell
Load capacitance	5-7pF typically
Pulse shape	Triangular (fast rise, relatively slow decay)
Rise time	1-3ns
Recovery time	5us typically
Pulse amplitude	2800...3800V adjustable by default, other on request
Bias voltage	No
Other	Adjustable delay relative to the diode driver
Warning – Pockels cell's electrodes must be isolated from the ground and cannot be grounded in any way	
COOLING	Passive cooling provided through the driver's bottom-surface plate attached to the customer's external cold plate/heatsink. The customer's responsibility is to keep the plate temperature below 70 °C
PROTECTIONS	Door interlock connection, overheating, buffer voltage too low, buffer voltage too high, TEC out of range, input frequency is too high
INTERFACES	RS-232 interface (RS-485 on request)

OTHER	Synchro inputs (2pcs) Synchro output (1pc)
ENVIRONMENT:	
Operating temperature	0...+40 °C at full output (guaranteed) –30...+55 °C at 50% of the output power (designed for)
Storage temperature	–40...+85 °C
Humidity	<90%, non-condensing
Shock / vibration	No special requirements

MECHANICAL

Size (LxWxH)	From ~180x70x30mm to ~180x70x35mm (see also the dimensional drawing below)
Weight	<0.5kg

Dimensional drawing



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

How to order?

SDC-150-YYYY-[VVVVV], where:

- YYYY codes the voltage version of the driver (nominal value, can be 63V, 80V, 100V, 126V, 160V, or custom). The maximum output current, internal capacitor bank capacitance, average output power, and other parameters are fixed for each voltage version, see details in the table below.
- VVVVV code defines the type of serial interface, it can be either RS232 or RS485. By default, the RS232 version is supplied.

Parameter	Value ⁽¹⁾				
Model P/N	SDC-150-63V	SDC-150-80V	SDC-150-100V	SDC-150-126V	SDC-150-160V
Embedded capacitor bank:					
Voltage (V_{MAX})	63V	80V	100V	126V	160V
Capacitance	13mF	6.1mF	3.9mF	3.3mF	1.5mF
Capacitor charging power supply:					
Buffer voltage ($V_{MIN}=V_{IN}+5V$)	$V_{MIN}...63V$	$V_{MIN}...80V$	$V_{MIN}...100V$	$V_{MIN}...126V$	$V_{MIN}...160V$
Maximum power in dependence on buffer voltage ⁽²⁾ ($V_{MIN}=V_{IN}+5V$)	>50W @ $V_{MIN}...63V$	>50W @ $V_{MIN}...80V$	>50W @ $V_{MIN}...100V$	>50W @ $V_{MIN}...126V$	>50W @ $V_{MIN}...160V$
Diode driver:					
Maximum output current:					
- @ 250us (I_{250})	350A	250A	200A	200A	150A
- @ 300us (I_{300})	300A	200A	150A	150A	100A
Minimum output current (I_{MIN})	10A	10A	10A	10A	5A
Recommended diode voltage ⁽³⁾ :					
- @ I_{300} , 300us	<48V	<62V	<80V	<104V	<132V
- @ $\frac{1}{2} I_{250}$, 250us	<53V	<69V	<87V	<110V	<143V
Maximum pulse width (T_{MAX})	300us	300us	300us	300us	300us
Minimum pulse width	50us	50us	50us	50us	50us
Maximum repetition rate ⁽⁴⁾	30Hz	30Hz	30Hz	30Hz	30Hz
Output limitations:					
Energy limit ⁽⁴⁾ ($I_{300} \cdot V_{MAX} \cdot T_{MAX}$)	~5.6J	~4.8J	~4.5J	~4.5J	~5.2J
Power limit	50W	50W	50W	50W	50W
Guaranteed regimes	300A/48V/250us/10Hz 150A/53V/250us/20Hz	200A/62V/300us/10Hz 100A/69V/250us/20Hz	150A/80V/300us/10Hz 100A/87V/250us/20Hz	150A/104V/250us/10Hz 100A/106V/250us/20Hz	100A/132V/300us/10Hz 50A/140V/250us/20Hz
TEC	+	+	+	+	+

Pockels cell driver	QBD-nano-3801	QBD-nano-3801	QBD-nano-3801	QBD-nano-3801	QBD-nano-3801
Height (H)	<36mm	<31mm	<31mm	<36mm	<31mm

- (1) Customizations (e.g. non-standard output currents, non-standard diode voltages and other parameters, software customizations, Pockels cell driver customizations) are possible on request. Please contact the manufacturer for the details.
- (2) Models listed above deliver full output power in a wide range of the output voltages.
- (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 $\sim 5J$, and 30Hz operation is not possible due to the 50W average power limitation. Therefore, 30Hz operation is only possible when the operating current and/or voltage are significantly lower than I_{MAX} and V_{MAX} , respectively.

Examples:

- SDC-150-100V – fully standard 100V version with all the parameters as given above
- SDC-150-63V-RS485 – standard 63V version, but with RS-485 communication interface

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

A complete description of the current version of the RS-232 / RS-485 communication protocol is supplied with the SDC-150 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-150-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.

