

# VLC-3 Software

## DESCRIPTION

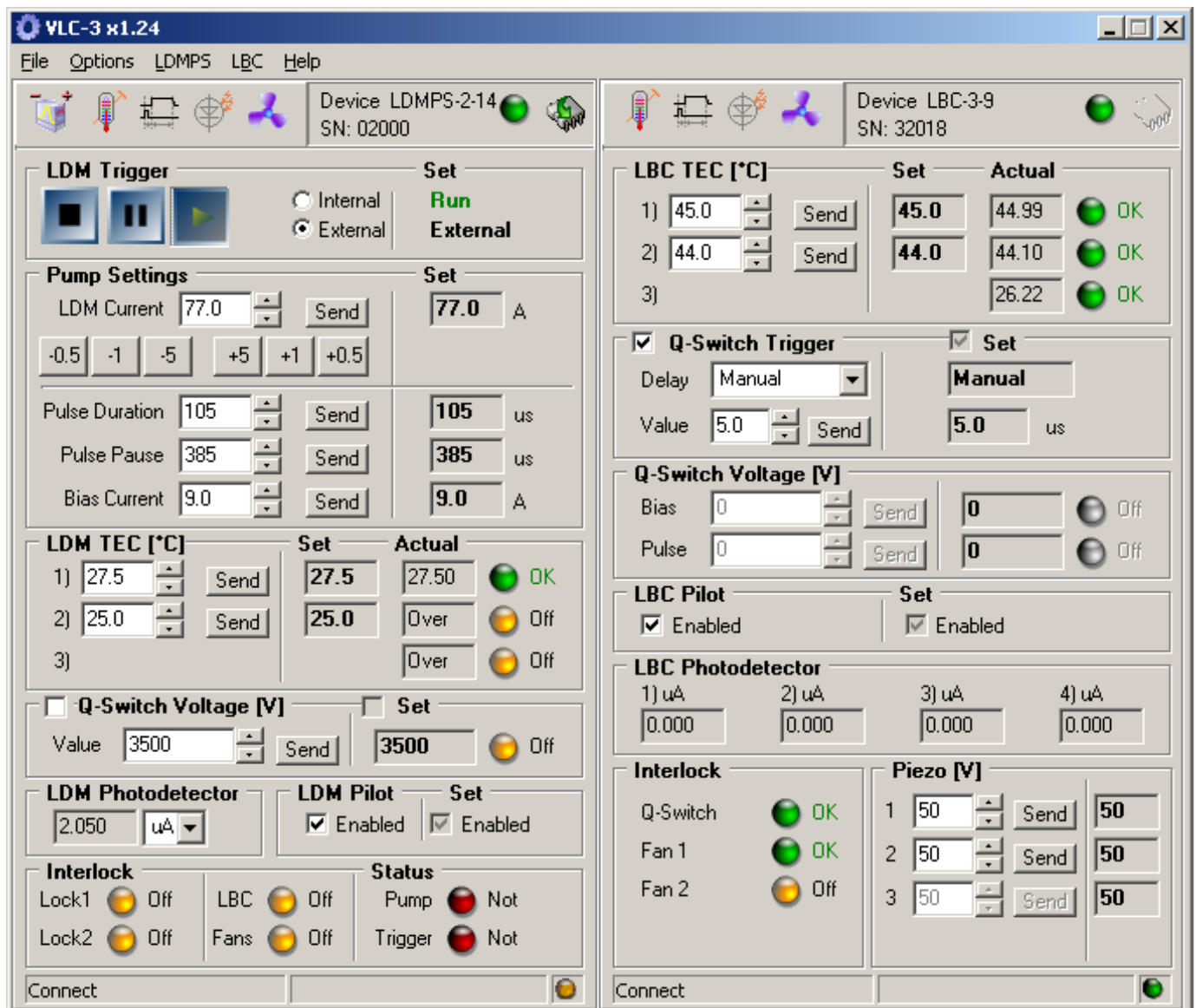
The VLC3 software is designed to control the parameters of the following two modules:

- Combined Driver for Laser Diode Modules and LDM TEC controller of LDMP5 or LDC type
- Laser Board Controller of LBC series aimed to control operation of Q-switched DIODE PUMPED SOLID-STATE LASER (DPSSL).

The software controls the parameters of two modules using one COM port RS232 or USB.

The software can also operate with each module separately. In this case the corresponding module is connected with the respective cable directly to a COM port of a PC.

### Main widow of the «VLC-3» software



The main window is vertically divided into two halves:

- the left part is to control the parameters of the module LDC or LDMP5;
- the right part is to control the parameters of the LBC.

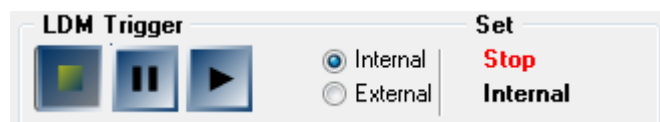
To operate with one of the modules, it is possible to swing the left (LDC) or right (LBC) part of the window which is not currently used by using the command «Disconnect» in the corresponding menu.

NOTE: While using only PS driver and high-power TEC controller the right part is disconnected.

## Adjustment fields of LDMPS/LDC parameters

**LDM Trigger** – operation regimes of the module (LDC):

- Internal – internal generation regime;
- External – waiting regime (waiting external trigger pulses).

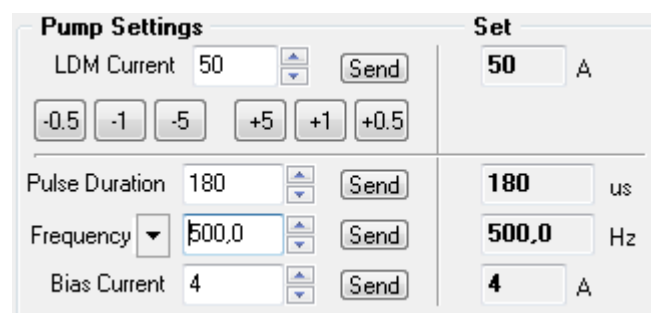


There are three possible states in every regime:

- Stop – current pulses are stopped and a Bias Current through Laser Diode Module (LDM) is switched off;
- Pause – current pulses are stopped and a Bias Current through LDM is switched on;
- Start – generation of current pulses through LDM (in the presence of trigger pulses), in this case Bias Current through LDM is switched on.

**Pump Settings** – electrical parameters of the current pulses through LDM in the module LDC:

- LDM Current – amplitude of the current pulse through LDM;
- Pulse Duration – duration of the current pulse through LDM;
- Pulse Pause / Frequency – allows to switch between parameters:
  - Pulse Pause – duration of the pause between current pulses in the “Internal” triggering mode; time after the end of the current pulse when external input trigger pulses are ignored In the “External” mode.
  - Frequency – pulse repetition rate for the “Internal” triggering mode and maximum repetition rate for the “External” mode.
- Bias Current – direct current through LDM during the pause between current pulses.



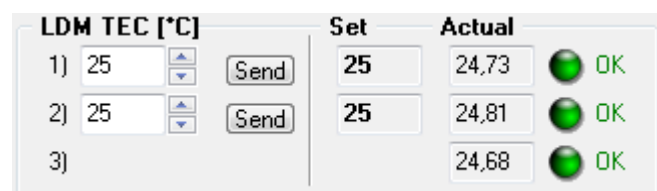
There is the corresponding button on the tool panel of LDC in the main window of the software.

**LDM TEC** – setting of the temperature of thermo-electrical Peltier elements in LDM:

Set – set temperature;

Actual – actual temperature.

- 1) temperature of the first laser line of the diode module (min 15°C, max 30°C);
- 2) temperature of the second laser line of the diode module (min 15°C, max 30°C);
- 3) temperature of the common hot side of the Peltier elements (min 12°C, max 50°C).



The indicator of the state of thermo-electrical Peltier elements:

- green – the temperature is in the specified range of the Interlock;
- red – the temperature is out of the specified range of the Interlock or the temperature is out of the range of maximally allowed values (in this case the corresponding thermo-electrical control (TEC) is automatically switched off);
- yellow – the Interlock state is not controlled or the corresponding TEC is switched off.

**Q-Switch Voltage** (only for LDMPS board) – regimes of a direct output voltage for Q-Switch:

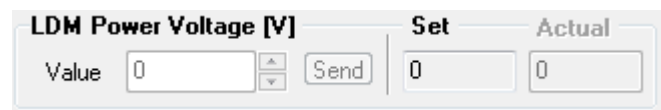
Q-Switch Voltage – switching on or switching off the output voltage; Value – setting the direct voltage value (min 1500 V, max 4000 V).



The indicator of the state of Q-Switch Voltage:

- green – the output voltage is normal;
- red – the output voltage is lower than the normal value or it is absent;
- yellow – the output voltage is switched off.

**LDM Power Voltage** (for LDC-4, LDC-5 boards and newer) – control of LDM Voltage. In order to use this feature, used LDM Power Supply must support controlling of output voltage by external signal.



Available parameters:

**Value** – setting of LDM Voltage value;

**Set** – set value of LDM Voltage;

**Actual** – measured value of LDM Voltage.

LDM Power Voltage state indicator. Click on it to enable/disable interlock. Indicator states:

- green – LDM Voltage is OK;
- red – difference between Set and Actual LDM Voltage Values is too big, interlock blocks laser operation;
- yellow – LDM voltage interlock disabled.

**LDM Photodetector** – regime of displaying the photodiode signal in LDM:

**µA** – displaying the photocurrent in microamperes (max 40 µA);

**W** – displaying the photocurrent in watts by means of a proportionality coefficient  $k$  (max 100 W/µA):  $P [W] = k [W/\mu A] \cdot I [\mu A]$ .

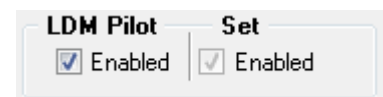


The proportionality coefficient value is stored in the energy-independent memory of the local microcontroller in the LDC module.

**LDM Pilot** – switching-on or -off the voltage of pilot laser in LDM.

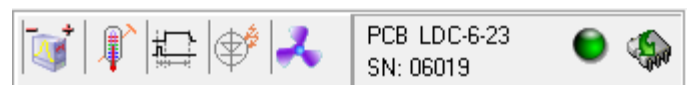
The direct output voltage ..... 3.3 V;

The maximally allowed current ..... 300 mA;



### Tool panel

Each vertical part of the software widow (LDC and LBC) has own tool panel for opening extra windows with extended parameters.



The area with the parameters of the connected module is located on the tool panel:

- Device – the version of the hardware of the corresponding module.
- Soft version – the version of the software of the local microcontroller of the corresponding module.

On the right side of the area with the parameters of the connected module, the indicator of the state of the corresponding module is located:

- green – the module is in a ready state;
- red – the module is in a waiting state;
  - for LDC: there are no current pulses through LDM and output trigger pulses;
  - for LBC: there are no output trigger pulses.
- yellow – interlocks are satisfied, and the module is in a ready state;
- grey – the module is switched off or is not connected.



In the right part of the tool panels of the modules LDC and LBC, the buttons are located for saving the set current parameters in the energy-independent memory of the corresponding module.

### Menu «File»

*Load parameters* – loading of the data set from the file and putting the parameters in the corresponding windows. To send the setting parameters in the corresponding module, it is necessary to press the button «Send» for every parameter;

*Save parameters* – saving of a set of the stated parameters to the file.

### Menu «Options»

*COM Port* – select the number of the COM Port. At the start, the software automatically detects all COM ports available at the PC.

*Password* – entering the password:

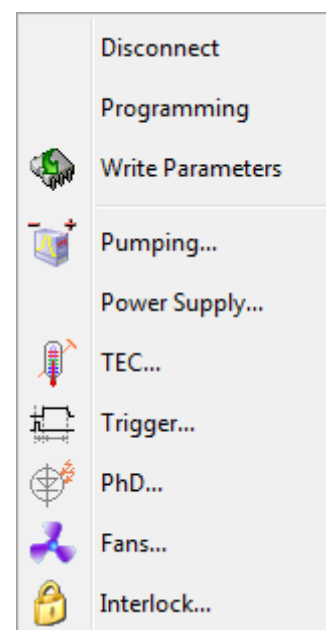
- to have the possibility to change maximum parameters of LDC;
- to have the possibility to reprogram the local microcontrollers.

### Menu «LDC» and «LBC»

*Disconnect / Connect* – disconnecting or connecting the corresponding module to the software «VLC3.exe». In the disconnected state, the part of the window (left or right) corresponding to the disconnected module is not displayed.

*Programming* – conversion of the local microcontroller of the corresponding module in the programming regime. This command is only available with a password for programming. The module in the programming regime becomes inaccessible for the «VLC-3» software. The programming of the local microcontroller is accomplished by means of the standard software «VSD.exe» of the company Analog Device.

*Write Parameters* – saving the saving the set current parameters in the energy-independent memory of the corresponding module. There is the corresponding button on the tool panel (on the right side of the state indicator of the corresponding module).



### Extended TEC control window

Additional “Expanded Thermo Option” window can be opened using menu LDC → TEC. It provides extended control of TEC parameters (controls for TEC1 and TEC2 are identical):

- Switch TEC On and Off (checkbox next to LDM TEC 1 (LDM TEC 2)). If TEC is switched Off it works only as a temperature sensor.
- Set target temperature.
- Switch temperature interlock On and Off and set the allowed temperature difference between Set and Actual temperature ( $\Delta T$ ). If interlock is On and

<input type="checkbox"/> LDM TEC 1	<input type="checkbox"/> Enabled
Temperature [°C]	Set      Actual
25	25      25,02
<input type="button" value="Send"/>	<input type="radio"/> Off

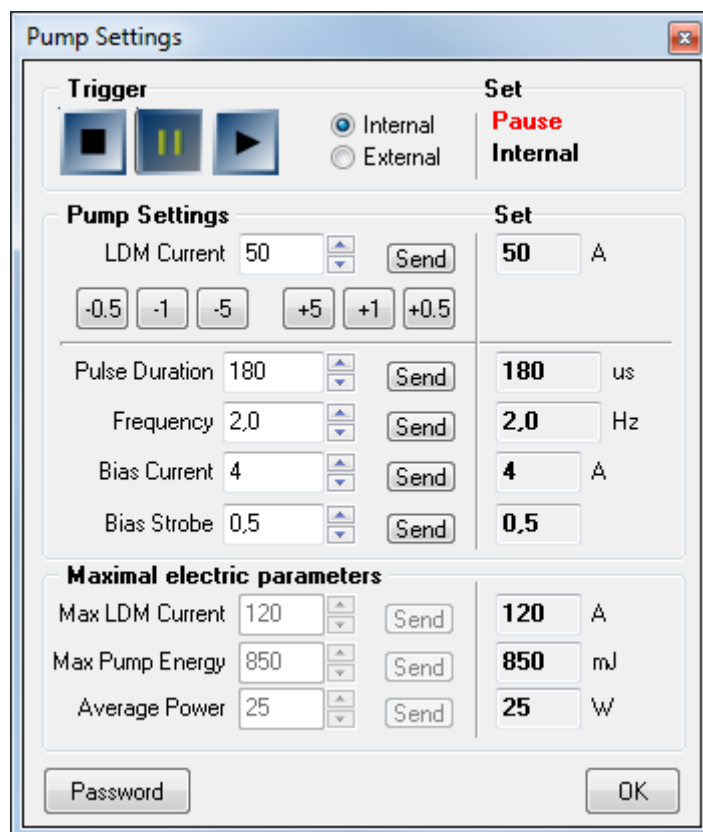
<input type="checkbox"/> Interlock [°C]	<input type="checkbox"/> Set
$\Delta T$ 0,7	0,7
<input type="button" value="Send"/>	<input type="radio"/> Off

difference between Actual and Set temperature values is bigger than  $\Delta T$  – laser operation is blocked.

- Set mode of operation for TEC (Heater or Heater/Cooler) and maximum allowed voltage for heating and cooling independently.
- Set thermostabilization PID-controller coefficient values. G – proportional gain coefficient, Tint – integral gain coefficient, Tdif – derivative gain coefficient.

TEC 3 tab provides indication of temperature and controlling of interlock, that will block laser operation if measured temperature is out of allowed range of operation.

Starting from VLC-3 1.46 version TEC 3 tab also provides control for setting of calibration coefficient B, that can be set according to the parameters of used NTC-thermistor. coefficient B value considered identical for all three TECs. Default value is 3450. For thermistor of 192-103LET-A01 type recommended value is B=3750. This feature requires firmware of LDC board LDC 6-18 or newer. If coefficient B is changed, LDC board should reinitialize. After reinitialization both Set and measured temperature values are calculated using new coefficient B value.



### Extended “Pump Settings” window

Additional window “Pump Settings” can be opened using menu LDC → Pumping or by double click in Pump settings section of the main window. It provides extended controls for electrical pump parameters.

“Pump Settings” region:

- Bias Strobe – coefficient, defining time interval after pump pulse, when Bias current is zero.

“Maximal electric parameters” region provides controls for maximum electrical pump parameters:

- Max LDM Current – maximum value of LDM current pulses amplitude;
- Max Pump Energy – maximum value of electrical energy E of LDM current pulse, calculated as:

$$E = V \times I \times \tau,$$

where V – volt drop across LDM, considered 2 V in this calculation;

I – LDM current pulse amplitude;

$\tau$  – LDM current pulse duration.

- Average Power – maximum average electrical power  $P_{av}$ , calculated as:

$$P_{av} = V \times I \times \tau \times f,$$

where  $V$  – volt drop across LDM, considered 2 V in this calculation;  
 $I$  – LDM current pulse amplitude;  
 $\tau$  – LDM current pulse duration;  
 $f$  – pump pulse repetition rate, calculated as  $f = 1 / (t_{pulse} + t_{pause})$ , where  $t_{pause}$  – duration of the pause between pulses.

### Extended “LDM Power Supply” window

Additional window “LDM Power Supply” can be opened using menu LDC → LDM or by double click in “LDM Power Supply” section of the main window. It provides additional controls for calibration of external power supply. In order to use this feature, used LDM Power Supply must support controlling of output voltage by external signal.

Available parameters:

- Value – set output voltage of LDM power supply;
- LDM Power Voltage state indicator. Click on it to enable/disable interlock. Indicator states:
  - green – LDM Voltage is OK;
  - red – difference between Set and Actual LDM Voltage Values is too big, interlock blocks laser operation;
  - yellow – LDM voltage interlock disabled.

«Power Supply Calibration» section allows to set calibration parameters for linear dependency of output voltage  $U_{LDMPower}$  from control signal DAC (DAC = 1 corresponding ~1 mV of control signal):

$$U_{LDMPower} = \frac{U_{Set}}{1200 - DAC_{Thr}} \cdot (DAC - DAC_{Thr})$$

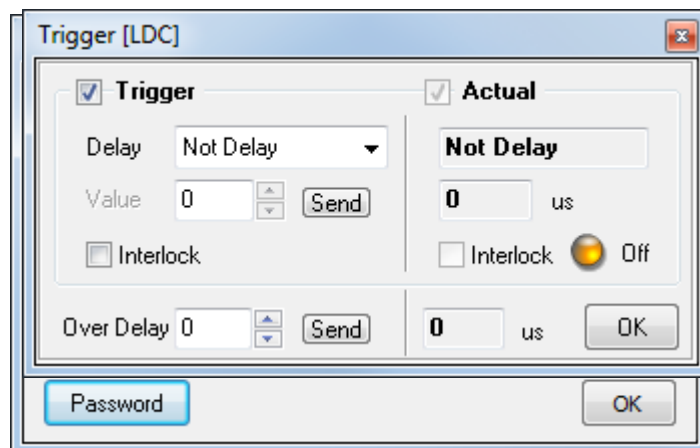
- $U_{Set}$  – output voltage at DAC = 1200;
- $DAC_{thr}$  – DAC signal value, corresponding to the  $U_{LDMPower} = 0$  V.

### Extended “Trigger [LDC]” window

Additional window “Trigger [LDC]” can be opened using menu LDC → Trigger or by double click in “LDM Trigger” section of the main window. It provides extended control of output trigger parameters.

Available parameters:

- Trigger – switches output trigger On and Off;
- Delay – set the mode of delaying output trigger after end of pump pulse:
  - Not Delay – output trigger pulse sent immediately (delay < 1 us) after end of the pump pulse;
  - Auto – delay value is set by external control signal;
  - Manual – delay value is set manually;
  - As Current Pulse – output trigger starts and ends synchronously with pump pulse;
- Value – value of output trigger delay for “Manual” delay mode;
- Interlock – enable/disable external interlock “LBC”;
- Over Delay – in “Auto” mode delay set to “Over Delay” value if external control signal is over 4.095 V.



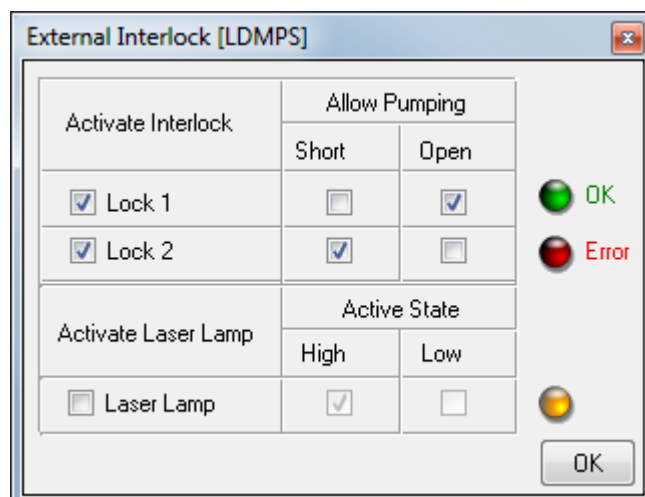


### Extended “External Interlock [LDC]” window

Additional window “External Interlock [LDC]” can be opened using menu LDC → Interlock or by double click in the interlock section of the main window. It provides controls for interlocks “Lock 1” and “Lock 2” and for DC output synchronized with pump pulses.

Available parameters:

- Lock 1 (Lock 2) – switch corresponding interlock On and Off;
- Allow Pumping – Interlock mode of operation:
  - Short – interlock is normally closed. Blocks laser operation if opened;
  - Open – interlock is normally opened. Blocks laser operation if closed;
- Laser Lamp – DC output synchronized with pump pulses.
- Active State – Laser Lamp mode of operation.
  - High – DC output is On when pump pulses are present;
  - Low – DC output is On when pumping switched Off.



The software «VLC3.exe» does not need an installation and operates under operating system Windows 7 or higher.

At the first start of the software, the ini-file «VLC3.ini» is created in which a user’s settings of the software are stored:

- COM Port number:  
default – COM1.
- Units of displaying of photo signals:  
 $\mu\text{A}$  or W (default is  $\mu\text{A}$ ).
- View of the software window:  
for the modules «LDC» and «LBC» (default);  
only for «LDC»;  
only for «LBC».

The ini-file «VLC3.ini» is resaved with the current settings every time after closing the software «VLC3.ini».

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WE RESERVE THE RIGHT TO MAKE ANY CHANGES THAT DO NOT AFFECT THE SPECIFIED PERFORMANCE OF THE LASER