



OPTOGAMA



LR100 driver



User manual



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1. Safety information



To ensure safety, please read this manual carefully before operating the device. Complete everything step by step. In case of any uncertainties contact the vendors.



Exposure to laser radiation may be harmful. Always wear suitable laser goggles to protect your eyes when working with the laser. All apertures which can emit laser light more than levels which are considered safe are identified with laser beam warning stickers.



High voltages and currents inside the laser housing, do not open it. Perform the connections exactly as described or else you can damage the computer and/or the electronics of the laser.



2. Laser driver LR100

The dimensions of the driver are 257 x 169.5 x 58 mm. Driver is controlled through physical key for On and OFF, physical button to START and STOP laser and pressure-sensitive touchscreen for parameter input and readout. Also, there is the possibility to fully control it through UART connection (see paragraph 3. PROGRAMMING GUIDE).



Figure 1. Laser driver LR100.

Table 1. LR100 laser driver parameters and limits.

Nr.	Parameter	Adjust Limits (units)	Description
1	Current	10-100 (A)	$\pm 0,5$ % after an initial adjustment period of $\sim 100\mu s$
2	Voltage	1,5-8 (V)	Automatic software control
3	Pump pulse time	100-5000 (μs)	Hardware-controlled maximum allowable pulse time 5100 μs (forced cut-off)
4	Trigger OUT	3.3 (V)	1 KOhm impedance
5	Trigger IN	2-10 (V)	TTL or pulse of $> 10 \mu s$ length
6	Trigger OUT delay	< 1000 (ns)	Delay between laser pulse and trigger out signal rising edge
7	Trigger IN delay	< 10 (μs)	Delay between Trigger pulse to pump pulse rising edge. If for example driver is used to pump RANGER laser, delay will additionally include pumping time of 1600-2500 μs (temperature dependent).
8	Trigger OUT jitter	< 3 (ns)	Hardware timing control (Std value)
9	Trigger IN jitter	< 3 (μs)	Software timing control (Std value)
10	Thermistor input	10 (kOhm)	Measurement range $-40 + 100$ C
11	Photodetector input		Photodetector (InGaAs photodiode) must be connected in photovoltaic mode.
12	Frequency	Single shot to 10Hz	Adjustment is done by entering period.

2.1 Touchscreen operation

Upon initial power-up, the driver capacitors enter a pre-charge phase (Fig. 2). Once the capacitors attain their designated operating voltage threshold, the system transitions to active mode, allowing laser operation to proceed.

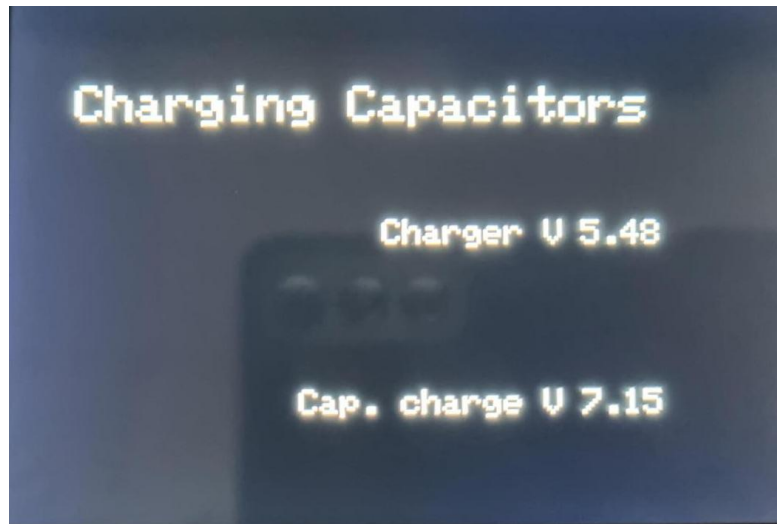


Figure 2. Capacitor pre-charge status display.

Once the capacitors reach full charge, the user interface is initialized and displayed (Fig. 3)

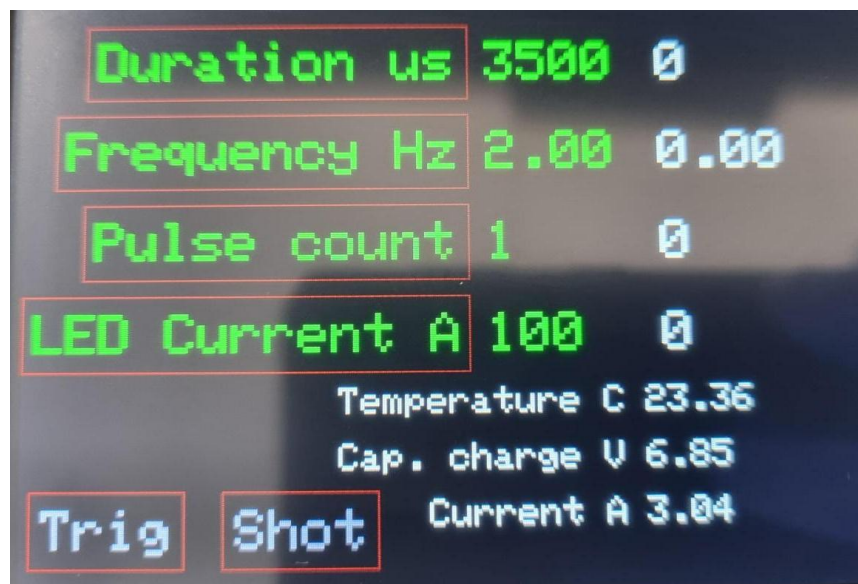


Figure 3. Laser driver control panel.

Parameter adjustment is initiated by selecting the desired parameter, highlighted with a red rectangle. Values can be modified either via a numeric keypad input or by selecting from predefined suggestions. The interface displays the allowable minimum and maximum limits for each parameter. Function keys operate as follows: 'B' scales the current value by a factor of 0.1; 'ESC' returns to the main user interface; 'C' deletes the last entered digit; and 'E' confirms and applies the entered value (Fig. 4).



Figure 4. Frequency entry dialog.

During laser operation, a flashing yellow indicator is displayed in the top-left corner of the screen. Input parameters are shown in green, while real-time measured values are displayed in white. Any newly entered values that have not yet been transmitted to the laser are highlighted in red. The 'Temperature °C' field indicates the current operating temperature of the laser in degrees Celsius (Fig. 5).

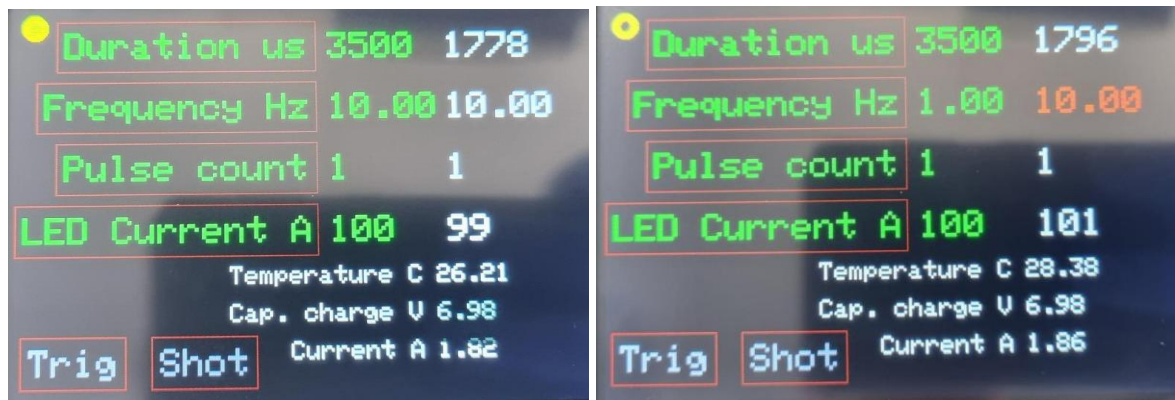


Figure 5. User interface during laser operation.

When operating in burst mode, the 'Pulse Count' parameter must be configured accordingly (Fig. 6). **Note:** As the pulse count increases, the maximum allowable burst duration must be adjusted proportionally to ensure proper system operation.

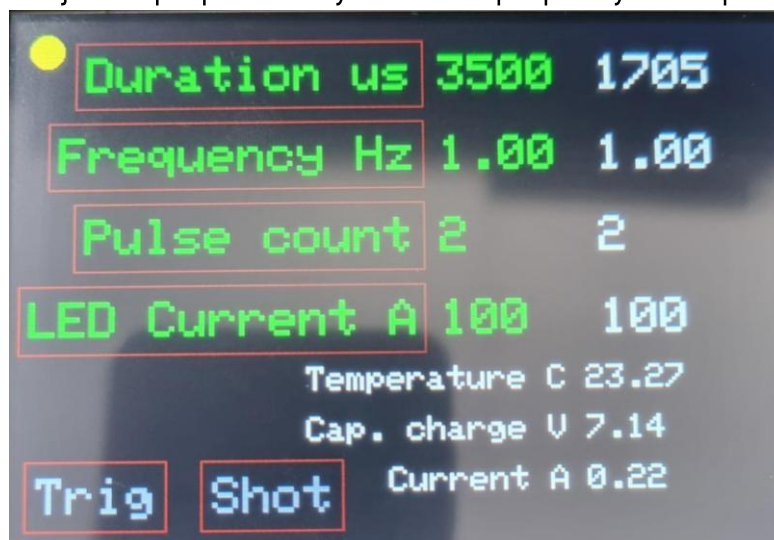


Figure 6. Burst mode operation.



External trigger operation is activated by pressing 'Trig,' while single-shot operation is enabled by pressing 'Shot' (Fig. 7). The user window changes accordingly.

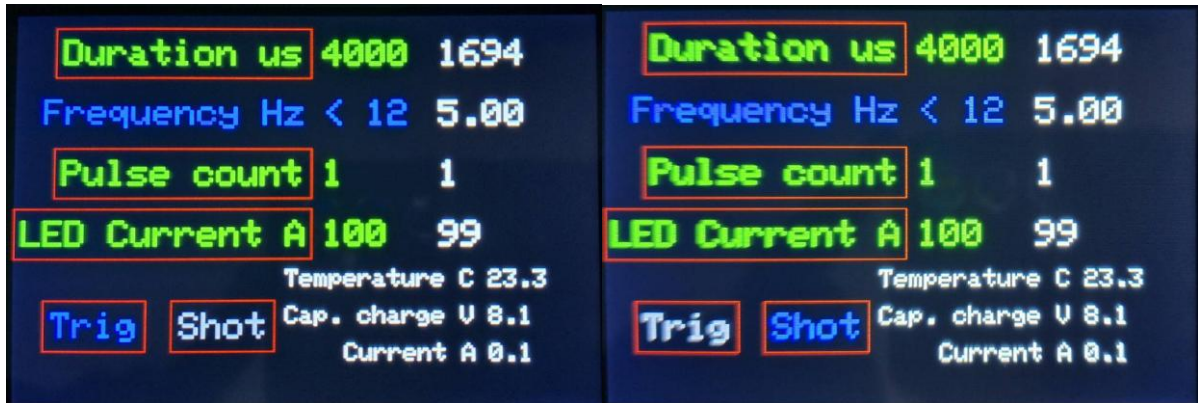


Figure 7. External trigger and single-shot operation.

If the driver's internal components reach a temperature above 80 C, the red indication 'OVERHEAT' appears and the driver stops generating pulses (Fig. 8). This can happen if one of the fans stopped operation or the air inlet is blocked, or ambient temperature is very high. To reset the driver the main key must be turned to position "OFF" and then to "ON" again.

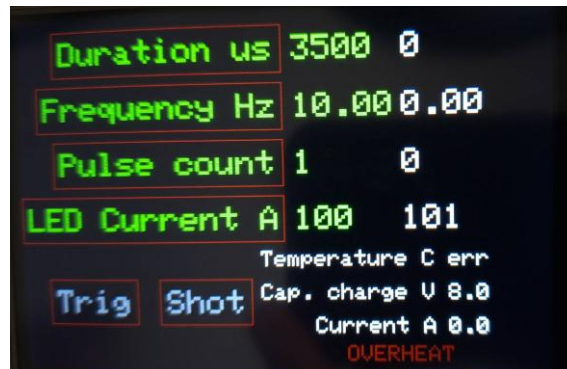


Figure 8. Overheating indication.

2.2 Connectors for the laser

The laser is connected through the connectors at the back of the driver. Laser diode power contacts are marked with + and -. Pins for photodiode and thermistor inside the laser are explained in Fig.8.

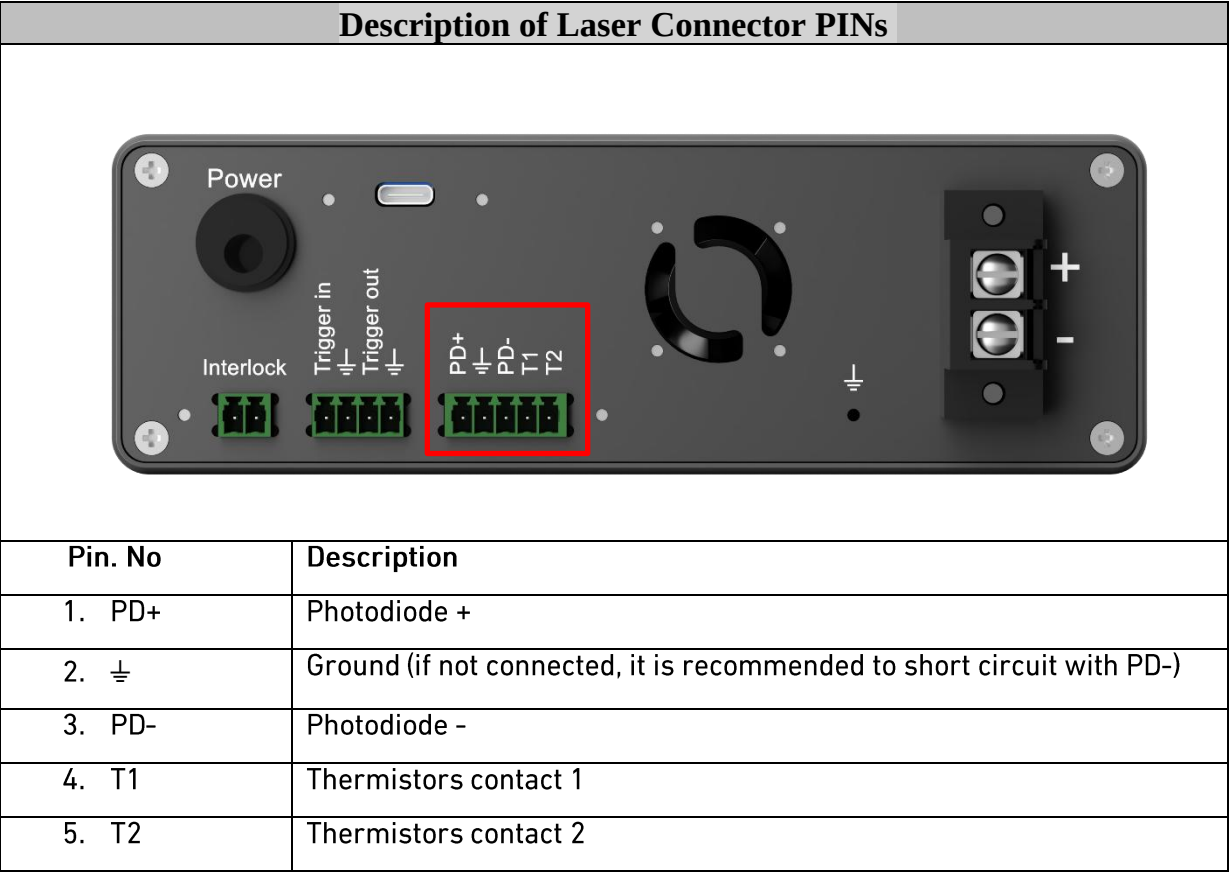


Figure 8. Laser connector description

2.3 TRIGGER IN and TRIGGER OUT

The Laser RANGER, utilizing the LR100 driver, can be modulated by an external output source. To facilitate this, the driver is equipped with TRIGGER IN connectors: a BNC connector on the front panel and a 15EDGK-3.5/4P connector (PIN 1 and PIN 2) on the rear panel (Fig. 9).

When operating in trigger mode, the laser is activated by a TTL high-level signal (>2 V rising edge). The maximum allowable trigger voltage is 10 V. External triggering is enabled by either sending the command STRIG:1 or selecting the "Trig" option via the touchscreen interface. The "Trig" text should appear in light blue. To disable external triggering, use the STRIG:0 command (refer to Chapter 3: Programming Guide for details) or press the touchscreen again.

In external triggering mode, the laser pump pulse is initiated after 500 μ s with the jitter Standard Deviation (Std) value of <3 μ s after receiving the trigger signal (rising edge of a 2–5 V pulse amplitude).

Other systems or components can be synchronized with the laser pulse via the TRIGGER OUT connectors: a BNC connector on the front panel and a 15EDGK-3.5/4P connector (PIN 3 and PIN 4) on the rear panel (Fig. 9). The output pulse is hardware-controlled at 3.3 V and is generated 500–1000 ns with jitter Std value of <3 ns after the trigger event.

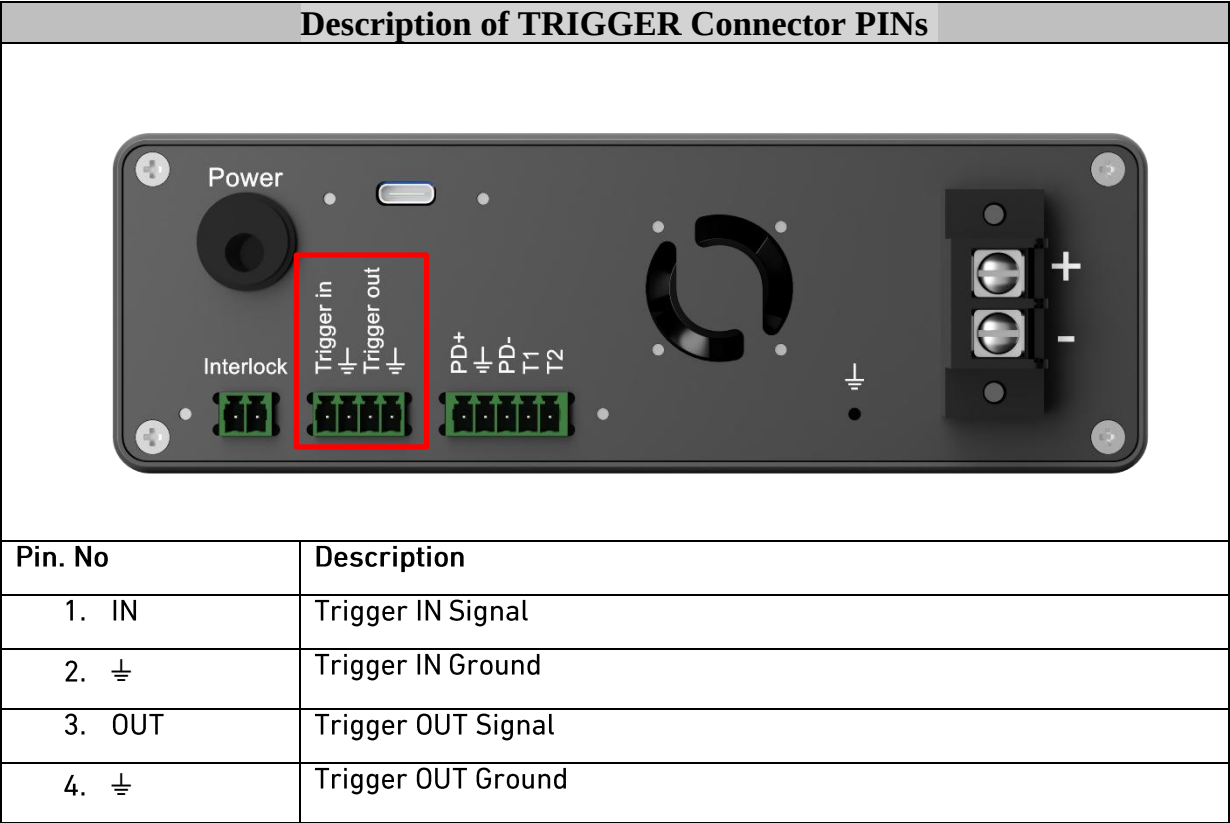


Figure 9. Trigger in/out connector description

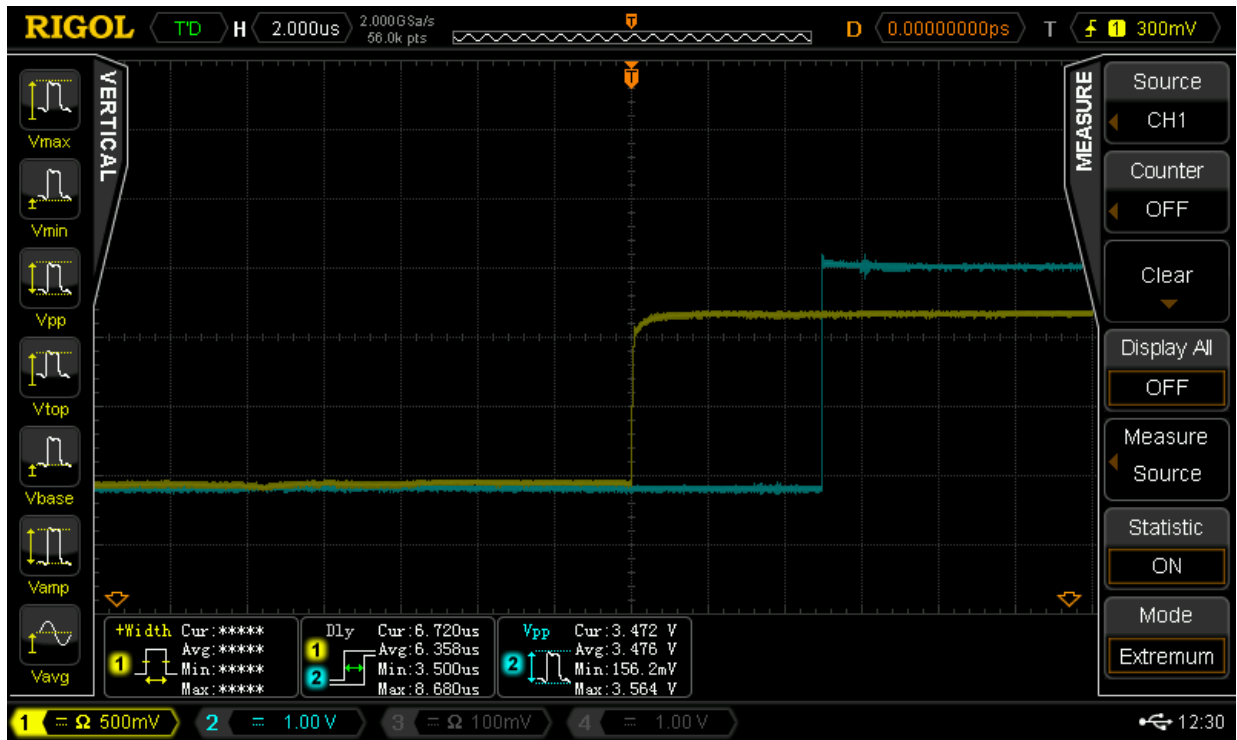


Figure 10. Trigger IN signal, delay and jitter

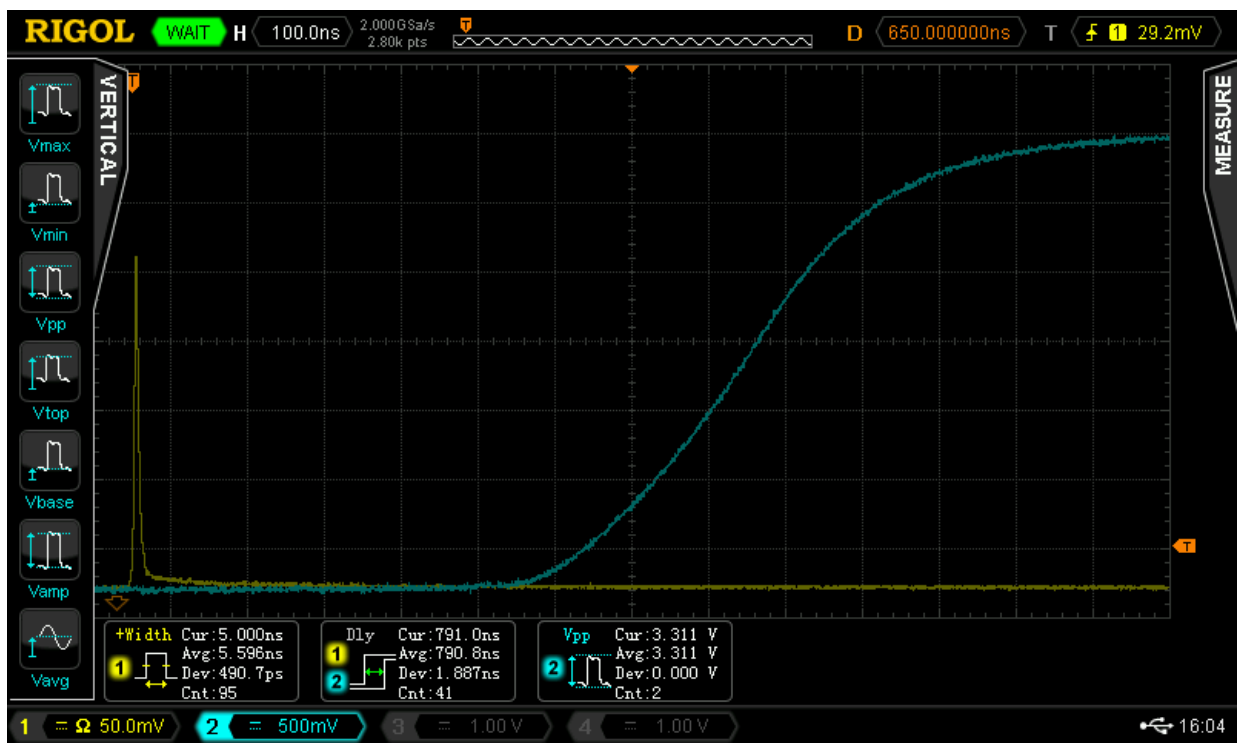


Figure 11. Trigger OUT signal, delay and jitter

2.4 Interlock

The INTERLOCK connector on the back works as an interruption circuit. When the terminals of the connector are open-circuited laser radiation is forcibly stopped and there is no possibility of resuming it until the Interlock circuit is closed and the start button is pressed.



3. Programming guide

The programming interface operates via a 3.3V UART to USB connection. When connected to a PC, it is recognized as a COM port with standard communication settings. The default configuration is a baud rate of 115200 bps, no parity, 8 data bits, and 1 stop bit (115200-N-8-1). All commands must be sent as ASCII-encoded strings in binary format, and each command must be terminated with a newline character. Responses are received in binary form, where each byte corresponds to an ASCII character.

3.1 The format of the commands

Nr.	Command	Description	Range from..to	Command format in ASCII	Response format/example in ASCII
1	Get last pulse current	Read all periodic current value measurements in last pulse (first number is period in ms)	10 to 100 (A)	AMPAL?	#AMPS,240,94,98,100,99,100,99,98\$
2	Set current	Set current value	10 to 100 (A)	AMPER:100	
3	Get current	Get current value average from last pulse	10 to 100 (A)	AMPER?	AMPER:98.01
4	Get frequency (period)	Read repetition rate period value from driver	1000000 to 100000 (us)	PERIO?	PERIO:100000
5	Set frequency (period)	Set repetition rate frequency	1 to 100 (mHz×100)	SFREQ:100	
6	Get pump pulse length (+/-50µs)	Get the last pump pulse value until first pulse	0 to 5000 (µs)	DURP1?	DURP1:1697
7	Get pump limit	Get pump limit value	100 to 5000 (µs)	DURAT?	DURAT:5000
8	Set pump limit	Set pump limit value	100 to 5000 (µs)	DURAT:1000	
9	Get voltage	Read voltage limit from driver	0 to 8 (V)	VOLTS?	VOLTS:6.41
11	Get internal temperature	Get internal board temperature value	-45 to 100		Future functionality
12	Get external thermistor temperature	Get laser thermistor temperature value		TEMPC?	TEMPC:28.8
13	Switch trigger in ON or OFF		1 0	STRIG:1 STRIG:0	Trigger regime ON Trigger regime OFF
14	Get FIRMWARE number			FIRMW?	FIRMW:18
15	Start	Start laser		START	
16	Stop	Stop laser		STOP _STOP	
17	State			STATE?	STATE:ON STATE:OFF



Nr.	Command	Description	Range from..to	Command format in ASCII	Response format/example in ASCII
18	Switch single shot regime ON or OFF		1 0	SSHOT:1 SSHOT:0	
19	Read all the parameters	#Laser Status, Temperature, Pump Pulse Limit, Pump Pulse Length, Period, Pulse Burst Limit, Pulse Burst Measured, Voltage, Current\$		PARAM?	#1,28.8,5000,1680,200000,1,1,6.41,98.01\$
20	Get set value of pulses in one burst			SHOTM?	SHOTM:1
21	Get measured value of pulses in one burst			SHOTS?	SHOTS:1
22	Set value of pulses in one burst		1 to 99	SHOTS:1	
23	Duration of pump pulse until first pulse and last pulse in one burst			DFILA?	#DURFIRSTLAST,3,1680,2274\$
24	Delay between Trigger IN and pump pulse (delay is measured between rising edges)		500 (µs) up to next pulse	STRIG:500	No response

3.2 Programming examples

All commands are formed from ASCII characters and sent as a byte sequence. For example, to read all the parameters using python programming language you should send the command followed by new line character, read the buffer and decode:

```
import serial
# Open COM1 with appropriate settings
ser = serial.Serial(
    port='COM1', # Change to the correct port if needed
    baudrate=115200,
    timeout=1 # Timeout for reading response
)
try:
    # Send the command with a newline character
    command = "PARAM?\n"
    ser.write(command.encode('ascii'))
    # Read the response from the device
    response = ser.readline().decode('ascii').strip()
    print(f"Device Response: {response}")
finally:
    ser.close() # Ensure the serial port is closed after use
```