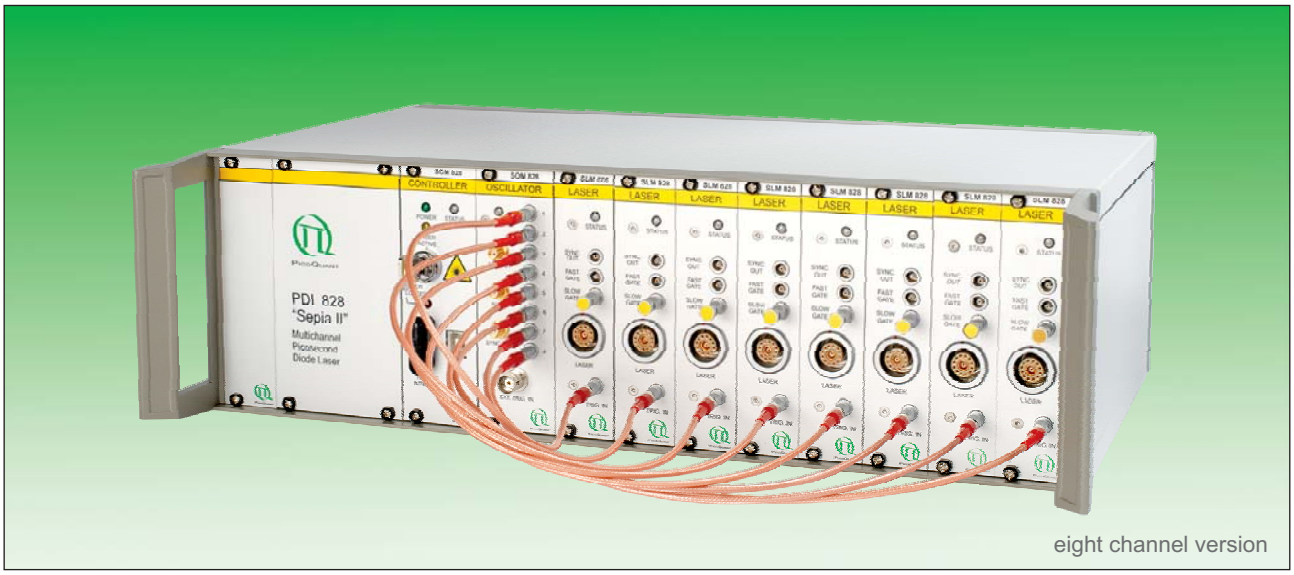
PDL 828 “Sepia II”

PicoQuant

Computer Controlled Multi-channel Diode Laser Driver

- Modular system, drives up to 8 laser or LED heads
- Pulsed and cw operation
- Computer controlled through USB
- Various operation modes: bursts, simultaneous, delayed, sequential, burst sequence
- Laser heads from 375 to 1990 nm, LED heads from 255 to 600 nm

two channel version



eight channel version

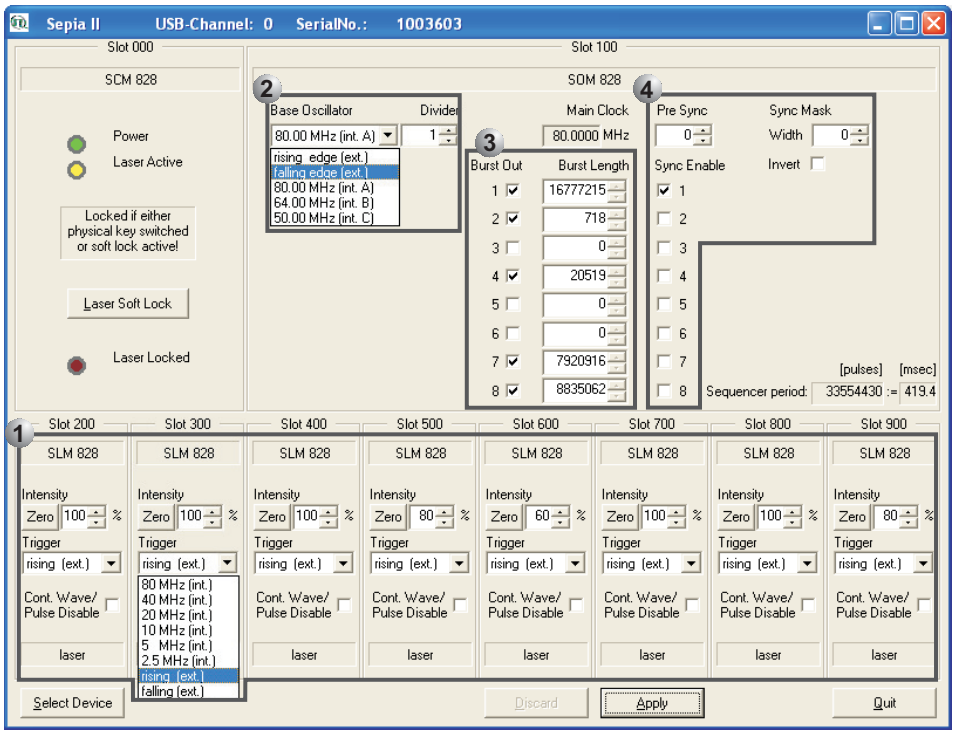
Applications

- Multicolour time-resolved fluorescence spectroscopy (PIE)
- Diffuse optical tomography
- Multiwavelength laser ranging / LIDAR
- Molecular imaging
- Quantum optics, single photon generation

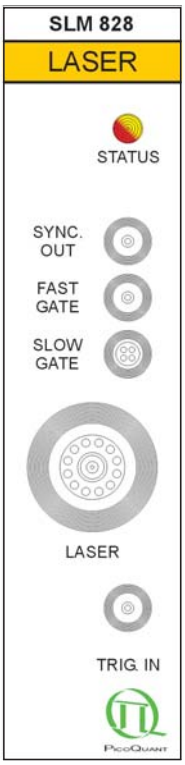
Computer Controlled Multichannel Diode Laser Driver

The PDL 828 “Sepia II” is a completely computer controlled multichannel diode laser driver connected to the PC via USB. The PDL 828 “Sepia II” provides maximum flexibility for multiple wavelengths applications and drives any combination of up to 8 laser or LED heads in parallel or in a user defined sequence. Laser heads with wavelengths between 375 and 1990 nm (LDH-P/D/FA Series) as well as pulsed LEDs from 255 to 600 nm (PLS Series) are available. The whole system can be configured and controlled through a dedicated Windows™ control software. Last settings are saved inside the PDL 828 “Sepia II” to allow stand-alone operation making it a powerful device for measurement automation. A DLL is also available and allows to access all functions of the PDL 828 “Sepia II” from custom programs.

The system consists of a mainframe with power supply, an oscillator module and up to eight laser driver modules. The laser driver module is fully compatible to all LDH-P Series laser heads and can in addition drive the latest generation of laser heads, which also allow cw operation (LDH-D-C Series).



Screenshot from “Sepia II” control software. Please see text for associations 1 to 4 shown above.



Laser driver module - SLM 828 (1)

A laser driver module is necessary for each laser head that needs to be connected and controlled at the same time by the PDL 828 “Sepia II”. Besides the connector for the laser head, the module provides its own synchronization output, a trigger input and two gating inputs (fast and slow gate).

Triggering modes

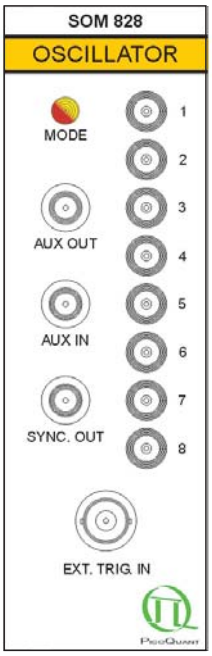
Each laser driver module can operate either independently from the other modules driven by its internal oscillator at six fixed, user-selectable frequencies (80, 40, 20, 10, 5 or 2.5 MHz) or synchronized to each other when using the external trigger signal from the oscillator module or any other source of a NIM compatible signal.

Emission intensity

The intensity of the laser emission is controlled via an internal voltage in steps of 1 % of its full scale value. However, due to the non-linear behaviour of laser diodes, the voltage setting does not linearly correspond to the output power, i.e. a voltage of 50 % does not correspond to 50 % of the maximum output power.
A special feature of the PDL 828 “Sepia II” is to switch between cw and pulsed mode with the LDH-D-C Series of laser heads.

Gating functions

For special applications like scanning devices, the laser driver module has two gating functions which allow to suppress the laser emission by an external signal: A slow gate, that reduces setting times of the laser heads to a minimum at slow on/off periods (seconds) and a fast gate, that can perform transitions within nanoseconds, i.e. in between two pulses. The fast gate also provides high pulse stability when the on/off signal is periodic and fast (milliseconds).

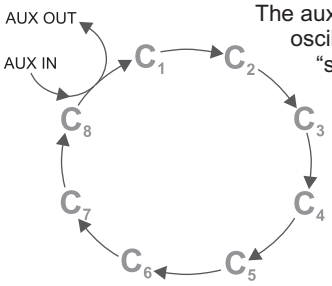


Oscillator module - SOM 828

The oscillator module has eight (individual) trigger outputs (channels) that can each be addressed individually. For example, channels can be combined to be activated at the same time or each channel can be individually activated in a sequence. To enable burst operation, multiple pulses can be output from one channel (or from combined channels) before the next channel becomes active. Additionally, the oscillator has its own synchronization output, an external trigger input as well as an auxiliary input and output connector.

Working principle
Generally speaking, the oscillator module works in a rotary fashion, which means that the programmed sequence of channel 1 through channel 8 must be completed before channel 1 becomes active again as illustrated in the figure below.

All channels can therefore be activated individually in a sequence. Adjacent channels can also be combined for simultaneous operation. The channels can, however, not be combined in any arbitrary fashion as the rotary working principle must be preserved.



The oscillator works in a rotary fashion, i.e. the channels (C) are activated in sequence: 1, 2, 3, 4, 5, 6, 7, 8, 1, 2, 3,...

The auxiliary input can be used to inhibit the oscillator to start the output period, i.e. to "start" the output on channel 1. If the signal is provided during the rotation through the channels, one full period will be finished nonetheless.

The auxiliary output is used to signal the start of a period. It is active when a period is finished (i.e. if channel 8 has been active) and a new one is about to start. This special time is defined as the moment, when the first pulse is output from channel 1.

Repetition rate 2
The oscillator module of the "Sepia II" provides a wide range of user-selectable repetition rates to generate pulses at the eight output channels of the module. In principle, all repetition rates are derived from an internal crystal oscillator along with a frequency divider. The oscillator module has three internal user-selectable crystal oscillators with base frequencies of 80, 64 and 50 MHz. Each base frequency can be further reduced by division though any integer value between 1 and 255. The highest repetition rate is therefore 80 MHz and the lowest repetition rate is 50 MHz/255~196 kHz. Instead of using one of the three internal oscillators, it is also possible to provide an external trigger signal. The frequency divider is also active on external trigger signals thereby allowing virtually all repetition rates between single shot and 80 MHz.

Defining bursts and combining channels 3
The oscillator module allows to output any number of pulses between 1 and 16772215 (16.7 million) to one channel before the next channel becomes active ("bursts"). Adjacent output channels can also be combined to emit pulses at the same time.

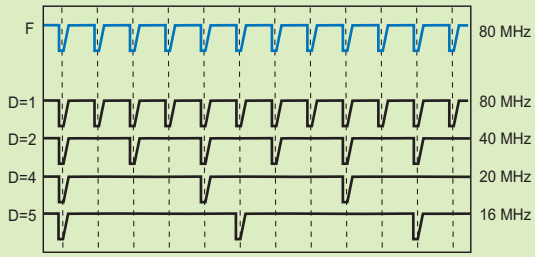
The output of each channel can be enabled or disabled. This does, however, not mean that the channel is "eliminated" from the rotary working principle. Instead, the programmed number of pulses is still processed, but simply no signal is present at the output. This is useful to insert time gaps between two bursts.

The synchronization signal 4
Each pulse that is output at any of the eight channels can be accompanied by a synchronization signal at the sync out connector of the oscillator module. This synchronization signal can be used to control external hardware like e.g. provide the start pulse for a TCSPC system. It can be enabled and disabled individually for each channel. One special feature of the PDL 828 "Sepia II" is that the synchronization signal can be time shifted at lower repetition frequencies. If the divider ratio is > 1, the sync pulse can be moved within the main clock period (the divided signal) in steps of the crystal oscillator's period (pre-sync). If the pre-sync is set to a value equal or higher than the divider, the synchronization signal will be disabled.

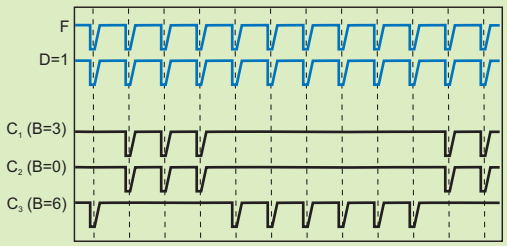
An additional option to influence the synchronization signal is to mask a defined number of pulses. Masking in this context means that no synchronization signals are output. The number of omitted pulses can be set to any integer value between 0 and 255.

The sync mask can also be inverted, i.e. not the number of omitted pulses is specified, but the number of actual output pulses. Again, the number of inverted masked synchronization pulses can be set to any integer value between 0 and 255. Of course, a value of 0 leads to no synchronization output at all.

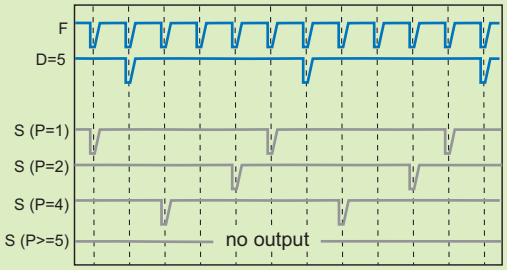
Pulse pattern examples



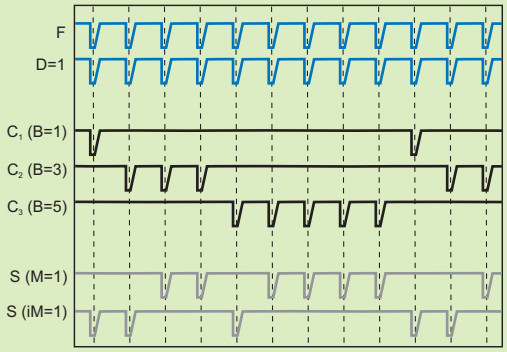
The repetition rate is derived from an internal crystal oscillator by division through any integer value between 1 and 255. If, for example, the base frequency (F) of 80 MHz is selected, a divider setting (D) of 2 yields a repetition rate of 40 MHz and a divider setting of 5 a repetition rate of 16 MHz.



By using different burst lengths it is possible to generate numerous pulse patterns. In this example, channel 1 and channel 2 are combined (burst length - B - of channel 2 is set to zero). Therefore, channel 1 and channel 2 emit three pulses at the same time, followed by six pulses out of channel 3.



The synchronization signal (S) can be output in advance to the output of each channel. The corresponding time difference (pre-sync P) can be changed in the stepsize of the crystal oscillator's period. If the pre-sync is set to a value equal or greater than the divider setting, the synchronization signal will be disabled.



The synchronization signal (S) can be masked (M) or inverted masked (iM), i.e. omitted resp. allowed for a defined number of pulses. As a result, pulses at the beginning resp. at the end of the burst are not accompanied by a synchronization signal.

Specifications

Mainframe

Large, L	1 slot for oscillator module, 8 slots for laser driver modules
Small, S	1 slot for oscillator module, 2 slots for laser driver modules
Power supply	100 to 250 VAC, 50/60 Hz, max. 250 Watts (large) or 130 Watts (small)
Dimensions	large, L: 464 × 310 × 140 mm (w × d × h) small, S: 250 × 310 × 140 mm (w × d × h)

Oscillator module

Outputs	8 trigger (NIM), 1 synchronization (NIM), 1 auxiliary
Inputs	1 external trigger, 1 auxiliary (TTL)
Operation mode	rotary, programmed sequence of one channel must be completed before next channel is activated, multiple channels can be combined
Oscillator type	crystal locked
Base frequencies	80, 64, 50 MHz (selectable)
Repetition frequency	user-selectable, derived from the selected base frequency or an external trigger source by division through any integer factor between 1 and 256

Synchronization output

Timing	synchronous to repetition frequency, timing position stepwise adjustable within the limits of the repetition frequency, stepsize equals base oscillator period
Masking	synchronization pulses can be inhibited (masked), mask size selectable in integer steps from 0 to 255, stepsize equals repetition period
Amplitude	< -800 mV into 50 Ohms (NIM)

Auxiliary output

Timing	at start of complete trigger sequence
Amplitude	+500 mV into 50 Ohms

External trigger input

Amplitude	-5 to +5 V (maximum limits)
Trigger level	-1 to +1 V
Frequency range	up to 40 MHz

Bursts

Burst length	up to 16.7 million pulses

Laser driver module

Inputs	1 trigger (NIM), 2 gating (TTL)
Outputs	1 synchronization (NIM), laser head connector
Operation mode	pulsed or continuous wave
Repetition frequency of internal oscillator	80, 40, 20, 10, 5 or 2.5 MHz (user-selectable)

Computer

Operating system	Windows™ 7/8/8.1/10
PC Interface	USB 2.0

Further available are Fluorescence Lifetime Spectrometer; Time-resolved Fluorescence Microscopes; Upgrade kit for Laser Scanning Microscopes; Picosecond / Nanosecond Pulsed, Modulated and Fast Swichted Diode Lasers; PC Modules for TCSPC. Please call for detailed information and data sheets. OEM Modules of all products are available upon request.

For all available types and wavelengths please go to:
http://www.picoquant.com/products/category/picosecond-pulsed-sources

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