PPL 400

Diode Laser for Nanosecond Pulses with Programmable Shapes

- Center wavelengths: 1030 nm, 1064 nm, 1950 nm, and more
- Pulse width between 1 ns and 330 ns with programmable pulse shape
- Repetition rates up to 1 MHz
- External trigger input
- Various operation modes: bursts, sequences, burst sequences
- Synchronization output

Applications

- Seeding of fiber or solid state amplifiers
- Micromachining
- Thin film removal
- Surface modification

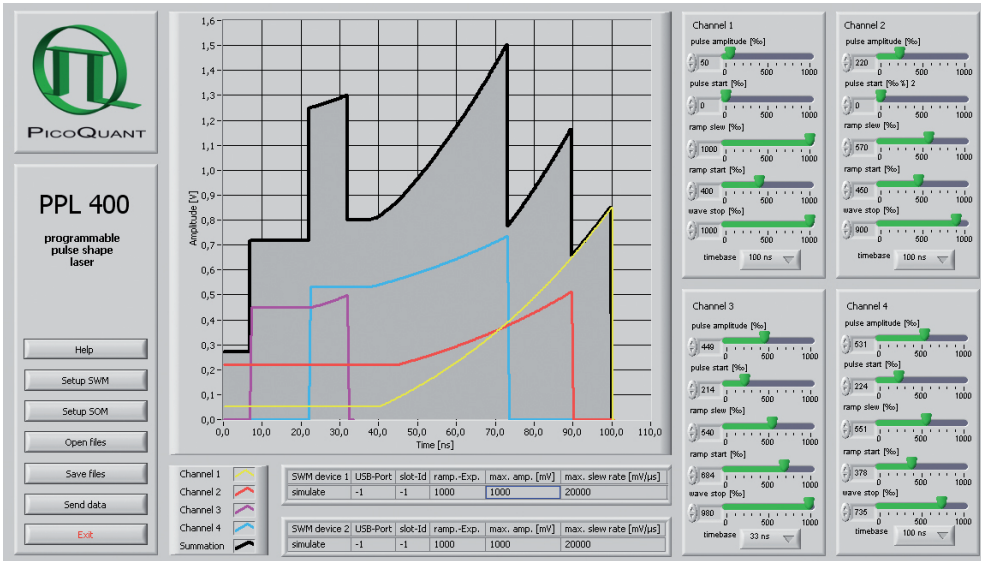
The PPL 400 is a stand-alone, computer controlled laser system for the generation of nanosecond pulses with programmable pulse shapes. It is connected to the host computer via a standard USB connection.
The central part of the laser system are up to 4 individual programmable waveform generators. Each generator outputs a combination of a flat top square pulse and a sawtooth with adjustable amplitude and slew rate. Start and stop times of the pulse can be chosen within one of three time bases in each channel. The outputs from all waveform generators are combined, and the sum signal is used to directly modulate the output of a laser diode. The optical output power of the laser is fully voltage controlled which allows a much better extinction ratio than electrooptically modulated sources.
The PPL 400 can be programmed through an easy to use Windows™ control software. The software provides a graphical preview of the output of all waveform generators as well as the combined signal that drives the laser diode and thus corresponds to the optical pulse‘s temporal modulation. Last settings are saved inside the PPL 400 to allow stand-alone operation.
The PPL 400 consists of a mainframe with a power supply, an oscillator module (SOM 828), one or two dual channel waveform generation modules (SWM 828) and a voltage controlled laser module (VCL 828) with polarization maintaining fiber output.

These tables are updated on a regular basis based on data of recently manufactured laser heads. Other specifications such as shorter pulse widths or higher powers than listed might be possible depening on the performance of diodes on stock. Please contact us for more information. All measurements shown may be subject to a 10 % callibration error. Each laser head undergoes an extensive burn-in test to ensure long-term stability and is shipped with a comprehensive set of test data. This test data is kept in our database, which already holds records of more than 18 years.

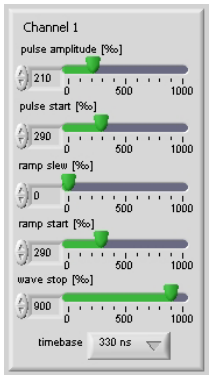
Specifications

Voltage controlled laser module (VCL 828)	
Inputs	two analog inputs for output from SWM 828, max. superimposed analog voltage: 1 V for full optical power
Optical output	
Center wavelength	1030 nm, 1064 nm, 1950 nm, others on request
Spectral width	typically < 1 nm, wavelength dependent
Output connector	FC/APC fiber connector
Output power	50 mW after single mode fiber
Output stability	3 % rms
Waveform generation module (SWM 828)	
Input	1 external trigger (NIM) from the SOM 828
Outputs	analog voltage 0 to 1 V (waveform defined by software settings), status control synchronization output
Number of waveform generators	up to 4
Waveform parameters	
Time base length	33 ns, 100 ns or 330 ns
Square pulse amplitude	freely selectable from 0 to 1 V
Square pulse start and stop time	freely selectable within chosen time base
Sawtooth (ramp) slew rate	freely selectable from 0 to 20 V/µs
Sawtooth (ramp) start time	freely selectable within chosen time base
Operation modes	
Continuous pulse mode	pulse repetition rate from once every minute to 1 MHz and single pulse
Burst pulse mode	up to 16 million pulses per burst, pulse repetition rate from 196 kHz to 1 MHz, burst repetition rate from once every minute to 500 kHz
Oscillator module (SOM 828)	
Input	1 external trigger
Outputs	8 trigger (NIM), 1 synchronization (NIM)
Operation modes	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, step size equals base oscillator period
Amplitude	< -800 mV into 50 Ohms (NIM)
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

Mainframe	
Power supply	100 to 250 VAC, 50/60 Hz, max. 250 Watts
Dimensions	464 × 310 × 140 mm (w × d × h)
Computer	
Operating system	Windows™ 7/8/8.1/10
PC Interface	USB



Waveform generation module - SWM 828



The PPL 400 can be equipped with one or two waveform generation modules (SWM 828). Each module includes two channels with six variable parameters for the generated waveform:

- the time base (33 ns, 100 ns or 330 ns)
- the start time and the stop time of the pulse within the chosen time base
- the amplitude of the flat top square pulse
- the start time and ramp slew of the sawtooth within the chosen time base

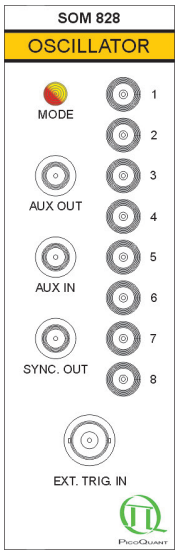
The combination of these parameters allows generation of a large variety of pulse shapes, from the very basic flat top square pulse to highly sophisticated multipeak patterns.
The output of each waveform generator is connected to one input of the voltage controlled laser module (VCL 828).
The SWM 828 also features a “status control” sync output which can be connected to, e.g., an amplifier system, in order to indicate proper operation. The SWM 828 can work at any repetition rate up to 1 MHz (depending on selected time base).

Voltage controlled laser module - VCL 828

The VCL 828 module is used to generate the laser emission based on the driving signals from the SWM 828 module. The output from one or two SWM 828 modules is internally combined and used to directly control the output power of the laser emission, which is highly linear with respect to the input voltage within a certain range. The laser has a lasing threshold of typically 1 mW and a maximum output power of typically 100 mW. Within this range the laser power corresponds to the control voltage between 10 mV and 1 V. At 0 V input voltage the laser is completely switched off and thus provides a very high extinction ratio between the pulses.

Oscillator module - SOM 828

The oscillator module of the PPL 400 is identical to the oscillator module of the PDL 828 “Sepia II” from PicoQuant.
It has eight (individual) trigger outputs (channel) that can 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.



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 figure 1. 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.
For the PPL 400, only two channels of the SOM 828 are used for providing trigger signals to the waveform generators. The six other channels are thus free and can for example be used to define pauses between two bursts.

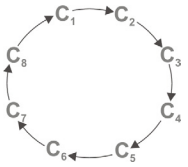


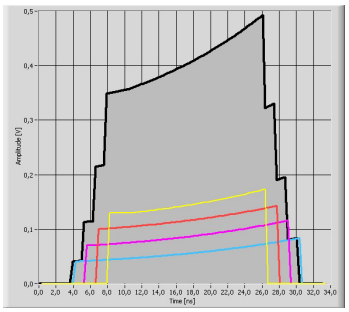
Fig. 1: The oscillator works in a rotary fashion, i.e. the channels (C) are activated in sequence: 1, 2, 3, 4, 5, 6, 7, 8, 1, 2, 3,...

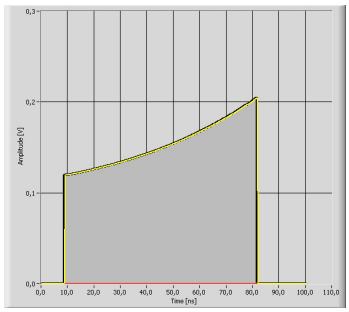
Repetition rate
The oscillator module provides a wide range of internal, user selectable repetition rates between 196 kHz and 80 MHz, which are derived from an internal crystal oscillator (80, 64 or 50 MHz) along with a frequency divider (1 to 255). The SOM 828 can also be triggered using external signals at any repetition rate up to 80 MHz. The frequency divider is also active on external trigger signals, which therefore permits to realize virtually any repetition rate between single shot and 80 MHz. The highest truly usable repetition rate for the SOM 828 within a PPL 400 device is, however, defined by the chosen time base on the waveform generation module and therefore limited to 30 MHz. At higher repetition rates, the pulses are no longer separated and the laser will switch to continuous wave operation.

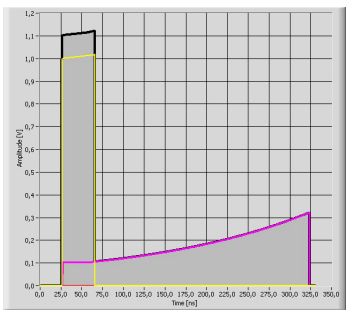
Defining bursts and combining channels
The oscillator module allows to output any number of pulses between 1 and 16,772,215 (16.7 million) to one channel before the next channel becomes active (“bursts”). Adjacent output channels can also be combined to emit pulses at the same time.
The output of each 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
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, e.g., indicate proper operation to an amplifier system.

Pulse shape examples







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