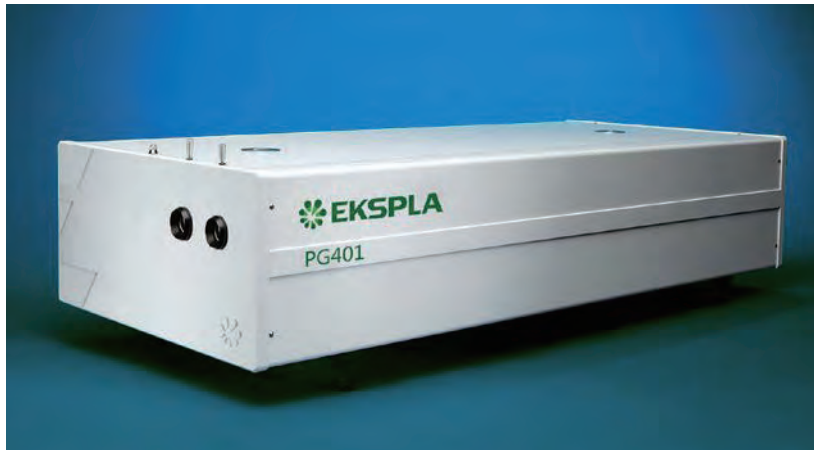


# PGx01 SERIES



Travelling Wave Optical Parametric Generators (TWOPG) are an excellent choice for researchers who need an ultra-fast tunable coherent light source from UV to mid IR.

## Design

The units can be divided into several functional modules:

- ▶ optical parametric generator (OPG);
- ▶ diffraction grating based linewidth narrowing system (LNS);
- ▶ optical parametric amplifier (OPA);
- ▶ electronic control unit.

The purpose of the OPG module is to generate parametric superfluorescence (PS). Spectral properties of the PS are determined by the properties of a nonlinear crystal and usually vary with the generated wavelength. In order to produce narrowband radiation, the output from OPG is narrowed by LNS down to  $6 \text{ cm}^{-1}$  and then used to seed OPA.

Output wavelength tuning is achieved by changing the angle of the nonlinear crystal(s) and grating. To ensure exceptional wavelength reproducibility, computerized control unit driven precise stepper motors rotate the nonlinear crystals and

diffraction grating. Nonlinear crystal temperature stabilization ensures long-term stability of the output radiation wavelength.

In order to protect nonlinear crystals from damage, the pump pulse energy is monitored by built-in photodetectors, and the control unit produces an alert signal when pump pulse energy exceeds the preset value.

For customer convenience the laser can be operated from master device or personal computer through USB (VCP, ASCII commands), RS232 (ASCII commands) or LAN (REST API) interfaces or from remote control pad with backlit display that is easy to read even while wearing laser safety glasses.

## Available models

Model	Features
PG401	Model has a tuning range from 420 to 2300 nm and is optimized for providing highest pulse energy in the visible part of the spectrum. The wide tuning range makes PG401 units suitable for many spectroscopy application.
PG501-DFG	Model has a tuning range from 2300 to 16000 nm. The PG501-DFG1 model is the optimal choice for vibrational-SFG spectroscopy setups.

## High Energy Broadly Tunable OPA

### FEATURES

- ▶ Ultra-wide spectral range from **193 to 16000 nm**
- ▶ High peak power (**>50 MW**) ideal for non-linear spectroscopy applications
- ▶ Narrow linewidth **<6  $\text{cm}^{-1}$**  (for UV <  $9 \text{ cm}^{-1}$ )
- ▶ Motorized hands-free tuning in 193–2300 nm or 2300–16000 nm range
- ▶ PC control via USB port (RS232 is optional) and LabVIEW™ drivers
- ▶ Remote control via keypad

### APPLICATIONS

- ▶ Nonlinear spectroscopy: vibrational-SFG, surface-SH, Z-scan
- ▶ Pump-probe experiments
- ▶ Laser-induced fluorescence (LIF)
- ▶ Other laser spectroscopy applications

**SPECIFICATIONS** <sup>1)</sup>

Model	PG401	PG401-SH	PG401-DUV	PG501-DFG1	PG501-DFG2
<b>Tuning range</b>					
DUV	-		193–209.95 nm	-	
SH	-	210–340, 370–419 nm	-		
Signal	420 – 680 nm	-			
Idler	740 – 2300 nm	-			
DFG				2300–10000 nm	2300–16000 nm
Output pulse energy <sup>2)</sup>	> 1000 µJ at 450 nm	> 100 µJ at 300 nm	> 50 µJ at 200 nm	> 250 µJ at 3700 nm, > 50 µJ at 10000 nm	> 250 µJ at 3700 nm, > 80 µJ at 10000 nm
Linewidth	< 6 cm <sup>-1</sup>	< 9 cm <sup>-1</sup>		< 6 cm <sup>-1</sup>	
Max pulse repetition rate	50 Hz				
<b>Scanning step</b>					
Signal	0.1 nm	-			
Idler	1 nm	-			
Typical beam size <sup>3)</sup>	~4 mm	~3 mm		~9 mm	
Beam divergence <sup>4)</sup>	< 2 mrad			-	
Beam polarization	-	vertical		horizontal	
Signal	horizontal	-			
Idler	horizontal	-			
Typical pulse duration	~15 ps	~12 ps	~12 ps	~20 ps	~20 ps
<b>PUMP LASER REQUIREMENTS</b>					
<b>Pump energy</b>					
at 355 nm	-	10 mJ		-	
at 532 nm	-			10 mJ	
at 1064 nm	-	2 mJ	6 mJ	15 mJ	
Recommended pump source <sup>5)</sup>	PL2231-50-TH, PL2251A-TH		PL2231-50-TH, PL2251A-TH	PL2231A-50-SH, PL2251B-SH	
Beam divergence	< 0.5 mrad				
Beam profile	homogeneous, without hot spots, Gaussian fit >90 %				
Pulse duration <sup>6)</sup>	30 ± 5 ps				
<b>PHYSICAL CHARACTERISTICS</b>					
Size (W x L x H)	456 x 633 x 244 mm	456 x 1031 x 249 ± 3 mm			
<b>OPERATING REQUIREMENTS</b>					
Room temperature	15 – 30 °C				
Power requirements	100 – 240 V AC single phase, 47 – 63 Hz				
Power consumption	< 100 W				

<sup>1)</sup> Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture. Unless stated otherwise, all specifications are measured at 450 nm for PG401 units, 3000 nm for PG501 units and 300 nm for PG401SH units and for basic system without options.

<sup>2)</sup> See tuning curves for typical pulse energies at other wavelengths. Higher energies are available, please contact Ekspla for more details.

<sup>3)</sup> Beam diameter is measured at the 1/e<sup>2</sup> level.

<sup>4)</sup> Full angle measured at the FWHM point.

<sup>5)</sup> If a pump laser other than PL2250 or PL2230 is used, measured beam profile data should be presented when ordering.

<sup>6)</sup> Should be specified if non-EKSPLA pump laser is used.



**CUSTOMIZED FOR SPECIFIC REQUIREMENTS**

Please note that these products are custom solutions tailored for specific applications or specific requirements.

Interested? Tell us more about your needs and we will be happy to provide you with tailored solution.

**PG401-DFG1 provides:**

- ▶ The broadest hands-free tuning range – from 420 to 10000 nm
- ▶ It can be further extended up to 16000 nm with -DFG2 option. It should be noted, that for the 8000 – 16000 nm range a different nonlinear crystal is used, and exchange of the crystals needs to be done manually

**PG402 features:**

- ▶ Gap-free tuning range 410 – 709, 710 – 2300 nm
- ▶ Linewidth < 18 cm<sup>-1</sup>

**TUNING CURVES**

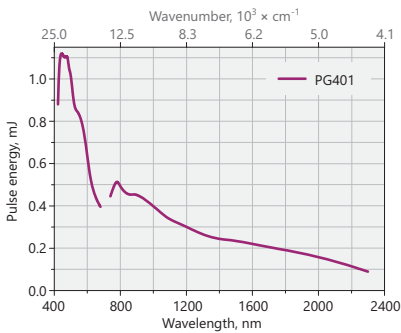


Fig 1. Typical PG401 model tuning curve  
Pump energy: 10 mJ at 355 nm

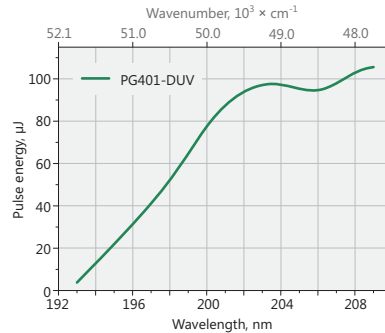


Fig 2. Typical PG401-DUV model tuning curve

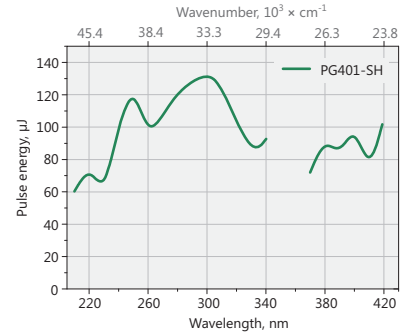


Fig 3. Typical PG401-SH model tuning curve. Pump energy: 10 mJ at 355 nm

Note: The energy tuning curves are affected by air absorption due narrow linewidth. These pictures present pulse energies where air absorption is negligible.

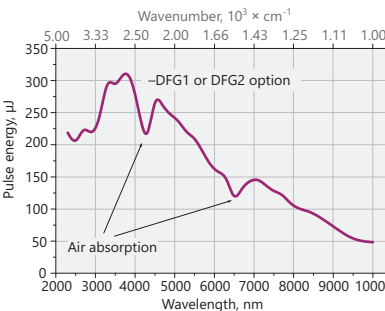


Fig 4. Typical PG501-DFG1 tuning curve in 2300–10000 nm range  
Pump energy: 7 mJ at 1064 nm

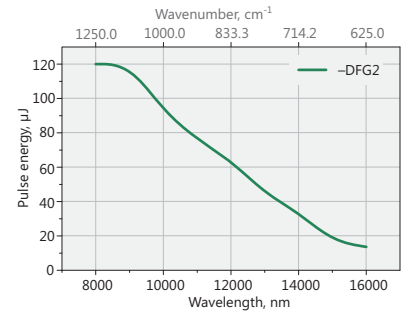


Fig 5. Typical PG501-DFG2 tuning curve in 8000–16000 nm range  
Pump energy: 15 mJ at 1064 nm

**RECOMMENDED UNITS ARRANGEMENT ON OPTICAL TABLE**

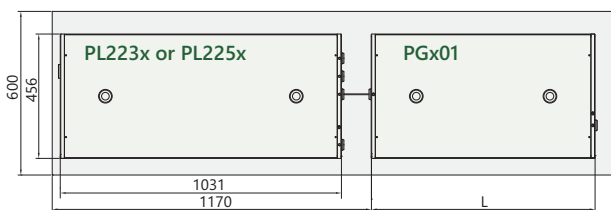


Fig 6. Arrangement of pump laser and PGx01 unit on optical table

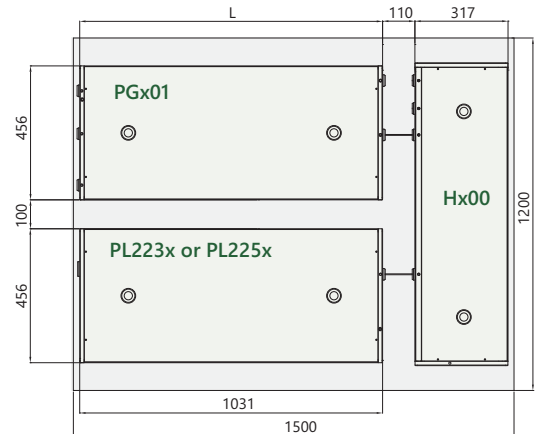


Fig 7. Recommended arrangement of pump laser and PGx01-DFGx unit on optical table

**OUTLINE DRAWINGS**

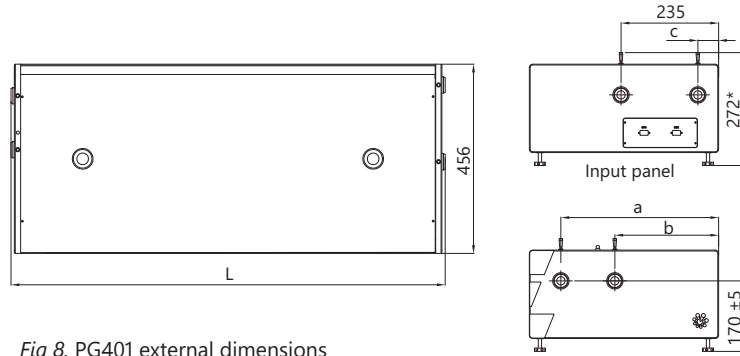


Fig 8. PG401 external dimensions

**OUTPUTS PORTS**

Model	L, mm	a, mm	b, mm	c, mm	Port 1	Port 2
PG401	633	380	x	x	420–680 nm, 740–2300 nm	–
PG401-SH	838	380	x	x	210–340 nm, 370–419.9 nm, 420–680 nm, 740–2300 nm	–
PG401-SH/DUV	1026	380	250	50	210–340 nm, 370–419 nm, 420–680 nm, 740–2300 nm	192–209.95 nm

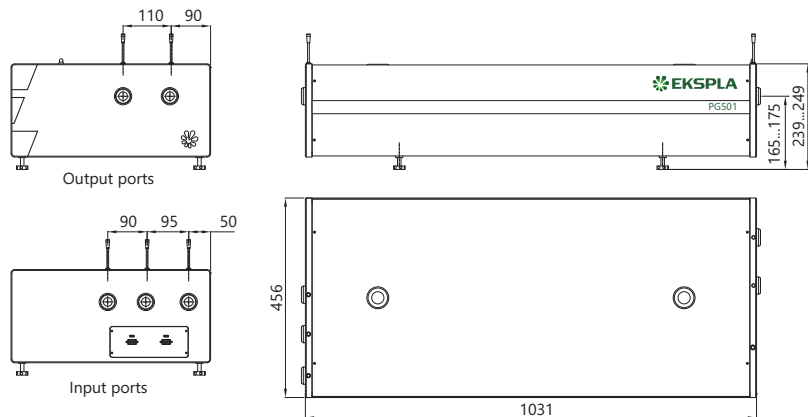


Fig 9. PG501 external dimensions

For SFG optional 532 nm output port 2.

**ORDERING INFORMATION**

**PG401-DUV**

Model  
PG4xx → 355 nm pump

01 → travelling wave, narrowed linewidth  
02 → travelling wave, not narrowed  
11 → synchronous pumping, narrowed

Optional tuning range extension  
DUV → 193–209.95 nm  
SH → 210–340 nm & 370–420 nm

*Custom products, tailored for specific applications. Inquire for other specifications.*

DFG1 → 2300–10000 nm; >250 μJ at 3700 nm  
DFG2 → 2300–16000 nm

**PG501-DFG1**

Model  
PG5xx → 532 nm pump

01 → travelling wave, narrowed linewidth

Tuning range  
DFG1 → 2300–10000 nm; >250 μJ at 3700 nm  
DFG2 → 2300–16000 nm

**Note:** Laser must be connected to the mains electricity all the time. If there will be no mains electricity for longer than 1 hour then laser (system) needs warm up for a few hours before switching on.

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# PGx03 SERIES

**kHz Repetition  
Rate Broadly  
Tunable OPA**



## FEATURES

- ▶ Picosecond pulses at **1 kHz** pulse repetition rate
- ▶ Hands-free wavelength tuning
- ▶ Tuning range from **210 nm** to **2300 nm**
- ▶ Narrow linewidth  $< 6 \text{ cm}^{-1}$
- ▶ Low divergence  $< 2 \text{ mrad}$
- ▶ PC control using USB (RS232 is optional) and LabVIEW™ drivers
- ▶ Remote control via keypad

PGx03 series Optical Parametric Generators (OPG) are designed to be pumped by 1 kHz mode-locked lasers with 1 W average power. An excellent choice is the PL2210A series mode-locked picosecond laser from EKSPLA.

The optical design is optimized to produce low divergence beams with moderate linewidth (typically  $12 \text{ cm}^{-1}$ ) at approximately 15 – 20 ps pulse duration. Due to the unique broad tunability range from 210 to 2300 nm these devices are an excellent choice for many spectroscopic applications.

Upon request the optical layout can be easily modified for pumping by other mode-locked lasers with high pulse energy or longer pulse duration.

Three models designed for pumping by up to the 3<sup>rd</sup> harmonic of Nd:YAG laser are available.

Microprocessor based control system provides automatic positioning of relevant components for hands free operation. Nonlinear crystals, diffraction grating and filters are rotated by ultra-precise stepper motors in the microstepping mode, with excellent reproducibility.

Precise nonlinear crystal temperature stabilization ensures long-term stability of generated wavelength and output power.

For customer convenience the system can be controlled through its USB type PC interface (RS232 is optional) with LabView™ drivers or a remote control pad. Both options allow easy control of system settings.

Available standard models are summarized in a table below. Please inquire for custom-built versions.

## APPLICATIONS

- ▶ Time resolved pump-probe spectroscopy
- ▶ Laser-induced fluorescence
- ▶ Infrared spectroscopy
- ▶ Nonlinear spectroscopy: vibrational-SFG, surface-SH, Z-scan
- ▶ Other laser spectroscopy applications

## Available models

Model	Features
<b>PG403</b>	Model has a tuning range from 410 to 2300 nm and is optimized for providing the highest pulse energy in the visible part of the spectrum. When combined with an optional Second Harmonic Generator (SHG), it offers the widest possible tuning range – from 210 to 2300 nm.
<b>PG503</b>	Model has a tuning range from 700 to 2200 nm and the highest pulse energy in the near-IR spectral range. PG503 is a cost-effective alternative to the narrow-band mode-locked Ti:S lasers.

**SPECIFICATIONS <sup>1)</sup>**

Model	PG403	PG403-SH	PG503
<b>OPA SPECIFICATIONS</b>			
Output wavelength tuning range			
SH	–	210 – 410 nm	–
Signal	410 – 709 nm		700 – 1000 nm
Idler	710 – 2300 nm		1150 – 2200 nm
Output pulse energy <sup>2)</sup>			
SH <sup>3)</sup>	–	10 µJ	–
Signal	50 µJ		70 µJ
Idler <sup>4)</sup>	15 µJ		25 µJ
Pulse repetition rate		1000 Hz	
Linewidth		< 12 cm <sup>-1</sup>	
Typical pulse duration <sup>5)</sup>		15 ps	20 ps
Scanning step			
SH	–	0.05 nm	–
Signal	0.1 nm		
Idler	1 nm		
Typical beam size <sup>6)</sup>		~ 3 mm	
Beam divergence <sup>7)</sup>		< 2 mrad	
Beam polarization <sup>8)</sup>			
SH	–	horizontal	–
Signal	horizontal		
Idler	vertical		
<b>PUMP LASER REQUIREMENTS</b>			
Min pump energy <sup>9)</sup>			
at 532 nm	–		0.45 mJ
at 355 nm	0.3 mJ		–
Pulse duration <sup>10)</sup>		30 ps	
Beam size <sup>10)</sup>		2 – 3 mm	
Beam divergence		< 1 mrad	
Beam profile homogeneous, without hot spots, Gaussian fit > 90 %			
Recommended pump source	PL2210A-TH	PL2210A-TH	PL2210A-SH
<b>PHYSICAL CHARACTERISTICS</b>			
Size (W × L × H)	456 × 820 × 273 mm		456 × 632 × 273 mm
<b>OPERATING REQUIREMENTS</b>			
Room temperature		15 – 30 °C	
Power requirements		100 – 240 V single phase, 47 – 63 Hz	
Power consumption		< 120 W	

<sup>1)</sup> Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture. Unless stated otherwise, all specifications are measured at 450 nm for PG403 units, at 800 nm for PG503 units and for basic system without options.  
<sup>2)</sup> Pulse energies are specified at selected wavelengths. See typical tuning curves for pulse energies at other wavelengths.  
<sup>3)</sup> Measured at 250 nm.  
<sup>4)</sup> Measured at 1000 nm.  
<sup>5)</sup> Estimated assuming 30 ps at 1064 nm pump

pulse. Pulse duration varies depending on wavelength and pump energy.

<sup>6)</sup> Beam diameter at the 1/e<sup>2</sup> level. Can vary depending on the pump pulse energy.  
<sup>7)</sup> Beam divergence measured at 450 nm.  
<sup>8)</sup> Separate output ports for SH, signal and idler ranges.  
<sup>9)</sup> Max pump energy is limited by available non-linear crystal sizes.  
<sup>10)</sup> Should be specified while ordering if non-Ekspla pump laser is used.



**TUNING CURVES**

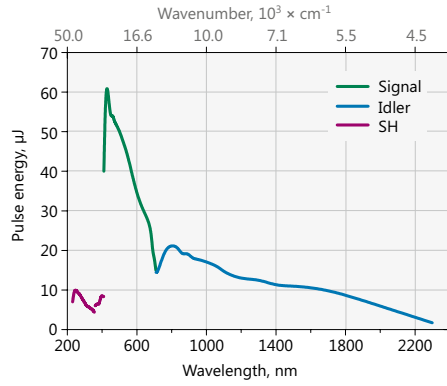


Fig 1. Typical PG403-SH model tuning curve.  
Pump energy – 0.3 mJ at 355 nm

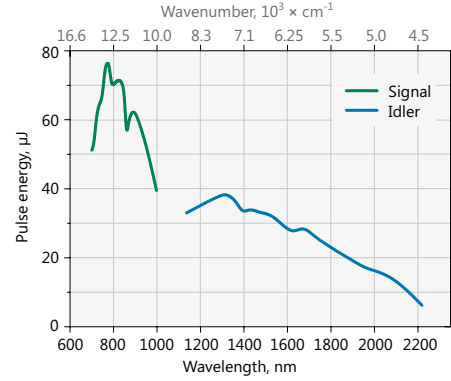


Fig 2. Typical PG503 model tuning curve.  
Pump energy – 0.45 mJ at 532 nm

**RECOMMENDED UNITS ARRANGEMENT ON OPTICAL TABLE**

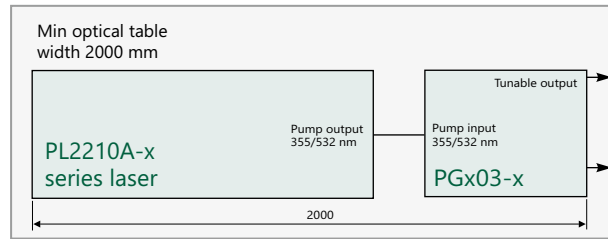


Fig 3. Arrangement of pump laser and PGx03 unit on optical table

**OUTLINE DRAWINGS**

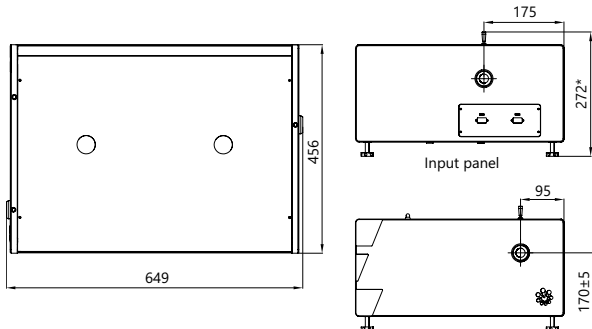


Fig 4. PGx03 model external dimensions

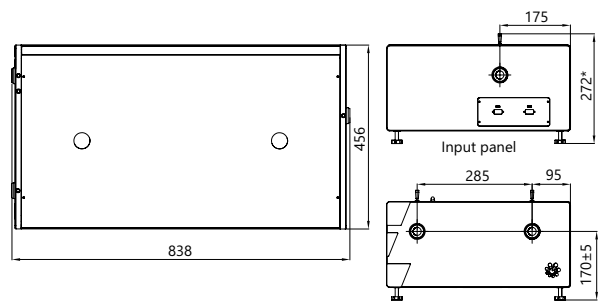


Fig 5. PGx03-SH model external dimensions

**ORDERING INFORMATION**

**Note:** Laser must be connected to the mains electricity all the time. If there will be no mains electricity for longer than 1 hour then laser (system) needs warm up for a few hours before switching on.

**PG403-SH**

Model  
PG403 → 355 nm pump  
PG503 → 532 nm pump

Optional tuning range extension  
SH → 210–410 nm

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# PT277 SERIES

Single Housing  
NIR-IR Range  
Tunable  
Picosecond Laser



## FEATURES

- ▶ 1400–4450 nm tuning range
- ▶ Nearly Fourier transform-limited linewidth
- ▶ Nearly diffraction limited divergence
- ▶ Output wavelength monitoring (optional)
- ▶ PC control via USB (RS232 is optional) and LabView™ drivers

PT277 series laser systems integrate a picosecond optical parametric oscillator and DPSS pump laser into a single compact housing. Mounting the components into one frame provides a cost-effective and robust solution with improved long-term stability and reduced maintenance costs.

The tuning range is for the model PT277 1400 – 2050 and 2200 to 4450 nm with nearly Fourier transform limited linewidth.

The microprocessor-controlled wavelength tuning is fully automatic. The wavelength controlling elements are mounted on precise micro-stepping motors. The temperature of the non-linear crystal is controlled by a precise thermocontroller with a bidirectional Peltier element, resulting in the fast tuning of crystal temperature. For customer convenience the system can be controlled through its USB type PC interface (RS232 is optional) with LabView™ drivers or a remote control pad. Both options allow easy control of system settings.

## APPLICATIONS

- ▶ Infrared microscopy
- ▶ Infrared spectroscopy

## TUNING CURVES

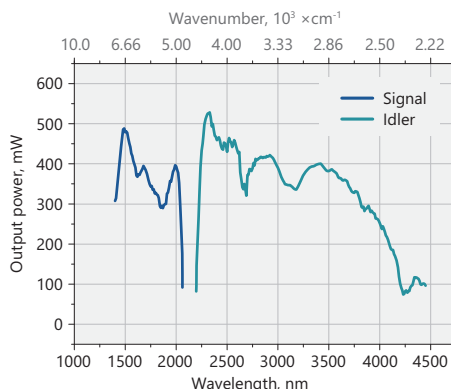


Fig 1. Typical output power of PT277 tunable laser. The power is shown only at the wavelengths where ambient air absorption is negligible

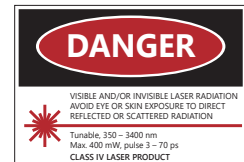


**SPECIFICATIONS 1)**

Model	PT277
Pulse repetition rate 2)	87 MHz
Tuning range	
Signal	1400 – 2050 nm
Idler	2200 – 4450 nm
Output power 3)	
OPO/OPG 4)	> 500 mW
Linewidth 4)	< 1 cm <sup>-1</sup>
Typical pulse duration 4) 5)	70 ps
Scanning step	
Signal	0.1 nm
Idler	0.1 nm
Polarization	
Signal beam	horizontal
Idler beam	horizontal
Typical beam diameter 4) 6)	~2 mm
Typical beam diameter, Idler 4) 6)	~5 mm
Typical beam divergence 4) 7)	< 2 mrad
<b>PHYSICAL CHARACTERISTICS</b>	
Unit size (W × L × H)	370 × 800 × 260 mm
Power supply size (W × L × H)	520 × 500 × 290 mm
Umbilical length	2 m
<b>OPERATING REQUIREMENTS</b>	
Cooling	water-air
Room temperature	22 ± 2 °C
Relative humidity	20 – 80 % (noncondensing)
Power requirements	100 – 240 V AC, single phase 50/60 Hz
Power consumption	< 1 kVA

1) Due to continuous improvement, all specifications are subject to change without notice. Parameters marked 'typical' are indications of typical performance (not specifications) and will vary with each unit we manufacture. Unless stated otherwise, all specifications are measured at 1064 nm and for basic system without options.  
 2) Inquire for custom pulse repetition rates.  
 3) Output powers are specified at selected wavelengths. See typical tuning curves for power at other wavelengths.

4) Measured at 1620 nm for PT277 model at signal range.  
 5) Pulse duration can vary depending on wavelength and pump energy.  
 6) Beam diameter at the 1/e<sup>2</sup> level and can vary depending on the pump pulse energy.  
 7) Full angle measured at the FWHM level.



**OUTLINE DRAWINGS**

**Note:** Laser must be connected to the mains electricity all the time. If there will be no mains electricity for longer than 1 hour then laser (system) needs warm up for a few hours before switching on.

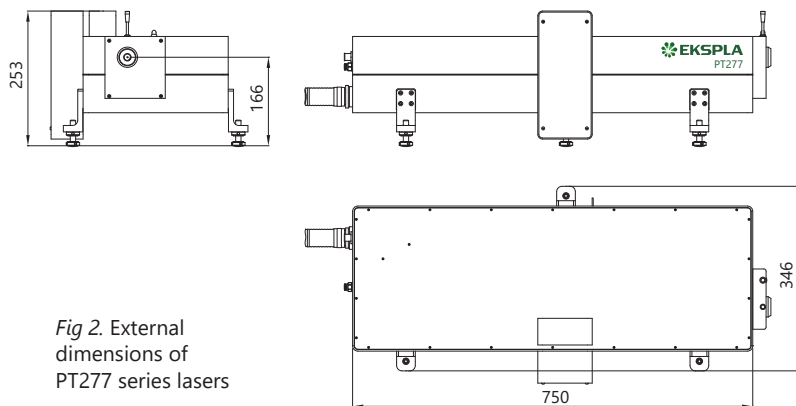


Fig 2. External dimensions of PT277 series lasers