PT403 SERIES

Tunable Wavelength Picosecond Laser

PT403 series laser systems integrate a picosecond 1 KHz repetition rate DPSS pump laser and optical parametric generator into a single housing. New picosecond tunable wavelength laser system provide from 210 to 2300 nm from the one box.

Unlike other solutions in the market, offering laser and OPO in different units, new approach features pump laser and OPO integrated into one unit. That delivers almost twice smaller footprint, shorter installation, better stability and other substantial benefits for user.

All-in one-box solution features all components placed into one compact housing. It means better overall stability because all potential causes for misalignment between separate units of pump laser and optical parametric generator are eliminated.

To ensure reliability industry and market tested solutions were employed during the build-up of PT403.

Pump laser is based on industry "gold standard" diode pumped Ekspla PL2210 series picosecond mode-locked laser. Improved output parameters and reduced maintenance costs are achieved by employing diode-pumped-only technology.

Optical parametric generator is based on PGX03 picosecond optical parametric amplifier systems. Fully automatized and microprocessor based control system ensures hands free precise wavelength tuning.

PT403 was built without sacrificing any parameters or reliability. The optical design is optimized to produce low divergence beams with moderate linewidth (typically <8 cm^{-1}) at approximately 15 – 20 ps pulse duration. Featuring 1 KHz repetition rate PT403 tuneable laser is versatile cost-efficient tool for scientists researching various kind of disciplines like time resolved fluorescence, pump-probe spectroscopy, laser-induced fluorescence, Infrared spectroscopy and other aplications.

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.

FEATURES

- *High pulse energy at kHz rates*
- *Diode pumped solid state design*
- *Air cooled – external water supply is not required*
- *Turn-key operation*
- *Low maintenance costs*
- *Optional streak camera triggering pulse with <10 ps rms jitter*
- *Hands-free wavelength tuning*
- *Tuning range **from 210 nm to 2300 nm***
- *Narrow linewidth **<8 cm^{-1}***
- *Low divergence <2 mrad*
- *PC control*

APPLICATIONS

- *Time resolved fluorescence, pump-probe spectroscopy*
- *Laser-induced fluorescence*
- *Infrared spectroscopy*
- *Nonlinear spectroscopy: surface-SH, Z-scan*
- *Other spectroscopic and nonlinear optics applications*

BENEFITS

- *Better long term stability (compared with layout where laser and OPO are in different units)*
- *Higher safety – all beams are in the box*
- *Shorter installation time*
- *Almost twice smaller footprint*

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SPECIFICATIONS [1]

Model	PT403	PT403-SH
OPA SPECIFICATIONS		
Output wavelength tuning range		
SH	–	210 – 410 nm
Signal	410 – 709 nm	
Idler	710 – 2300 nm	
Output pulse energy [2]		
SH [3]	–	10 µJ
Signal [3]	70 µJ	
Idler [4]	15 µJ	
Pulse repetition rate	1000 Hz	
Linewidth	<8 cm^{-1}	
Typical pulse duration [5]	15 ps	
Scanning step		
SH	–	0.05 nm
Signal	0.1 nm	
Idler	1 nm	
Typical beam size [6]	~ 3 mm	
Beam divergence [7]	< 2 mrad	
Beam polarization		
SH	–	horizontal
Signal	horizontal	
Idler	vertical	
OPERATING REQUIREMENTS		
Room temperature	22 ± 2 °C	
Power requirements	100 – 240 V single phase, 47 – 63 Hz	
Power consumption	<120 W	
Water service	not required, air cooled	

[1] 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 PT403 units for basic system without options.

[2] Pulse energies are specified at selected wavelengths. See typical tuning curves for pulse energies at other wavelengths.

[3] Measured at 250 nm.

[4] Measured at 1000 nm.

[5] Estimated assuming 30 ps at 1064 nm pump pulse. Pulse duration varies depending on wavelength and pump energy.

[6] Beam diameter at the $1/e^2$ level. Can vary depending on the pump pulse energy.

[7] Beam divergence measured at 450 nm.

OUTLINE DRAWINGS

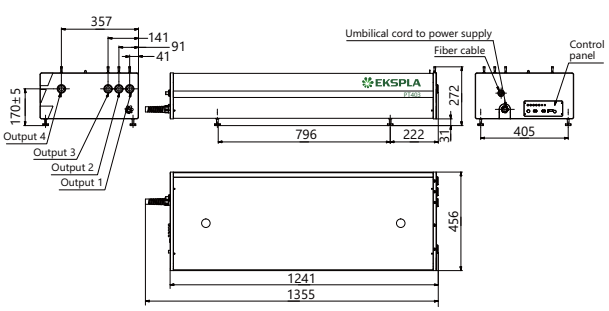


Fig 1. PT403 series laser head typical outline drawing

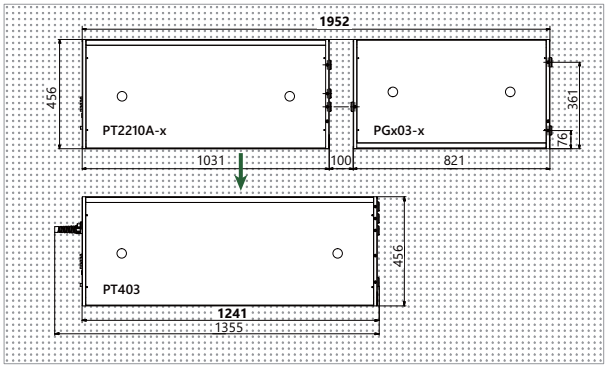
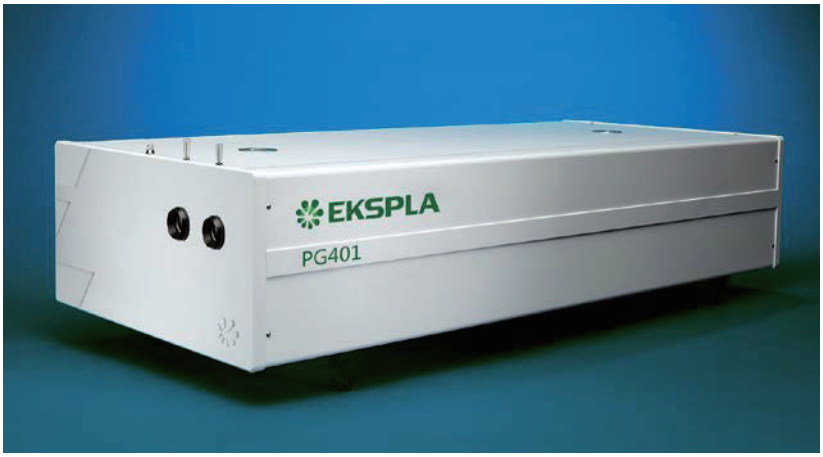


Fig 2. Compared with layout where laser and OPO are in different units, PT403 features almost twice smaller footprint

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

PGx01 SERIES

High Energy Broadly Tunable OPA



FEATURES

- *Ultra-wide spectral range from **193** to **16 000 nm***
- *High peak power (**>50 MW**) ideal for non-linear spectroscopy applications*
- *Narrow linewidth **<6 cm^{-1}** (for UV < 9 cm^{-1})*
- *Motorized hands-free tuning in 193–2300 nm or 2300–16 000 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*

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 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.

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SPECIFICATIONS [1]

Model	PG401	PG401-SH	PG401-DUV	PG501-DFG1	PG501-DFG2
Tuning range					
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 [2]	> 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^{-1}	< 9 cm^{-1}		< 6 cm^{-1}	
Max pulse repetition rate	50 Hz				
Scanning step					
Signal	0.1 nm	–			
Idler	1 nm	–			
Typical beam size [3]	~4 mm	~3 mm		~9 mm	
Beam divergence [4]	< 2 mrad			–	
Beam polarization	–	vertical		horizontal	
Signal	horizontal	–			
Idler	horizontal	–			
Typical pulse duration	~15 ps	~12 ps	~12 ps	~20 ps	~20 ps
PUMP LASER REQUIREMENTS					
Pump energy					
at 355 nm	–	10 mJ		–	
at 532 nm	–			10 mJ	
at 1064 nm	–		2 mJ	6 mJ	15 mJ
Recommended pump source [5]	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 [6]	30 ± 5 ps				
PHYSICAL CHARACTERISTICS					
Size (W x L x H)	456 × 633 × 244 mm	456 × 1031 × 249 ± 3 mm			
OPERATING REQUIREMENTS					
Room temperature	15 – 30 °C				
Power requirements	100 – 240 V AC single phase, 47 – 63 Hz				
Power consumption	< 100 W				

1) 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.

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

3) Beam diameter is measured at the $1/e^2$ level.

4) Full angle measured at the FWHM point.

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

6) 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^{-1}

TUNING CURVES

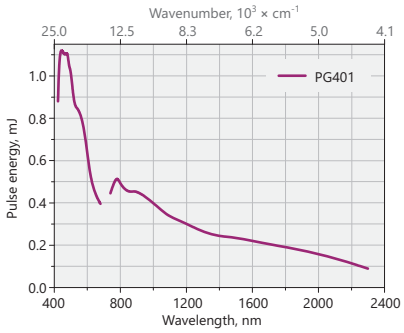

Fig 1. Typical PG401 model tuning curve
Pump energy: 10 mJ at 355 nm

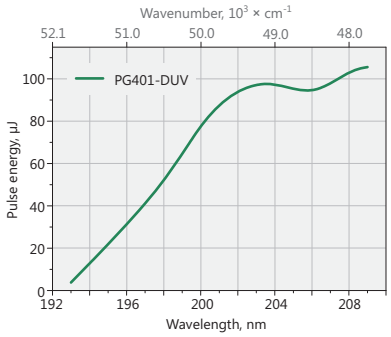

Fig 2. Typical PG401-DUV model tuning curve

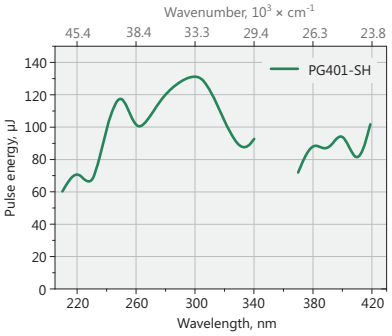

Fig 3. Typical PG401-SH model tuning curve. *Pump energy: 10 mJ at 355 nm*

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

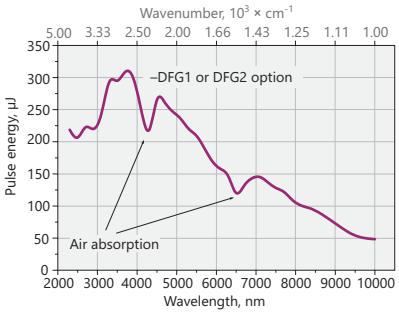

Fig 4. Typical PG501-DFG1 tuning curve in 2300–10000 nm range
Pump energy: 7 mJ at 1064 nm

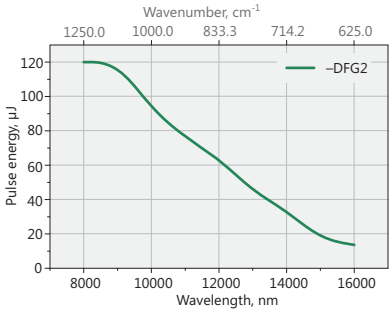

Fig 5. Typical PG501-DFG2 tuning curve in 8000–16000 nm range
Pump energy: 15 mJ at 1064 nm

RECOMMENDED UNITS ARRANGEMENT ON OPTICAL TABLE

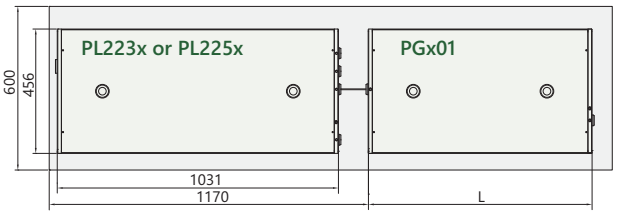

Fig 6. Arrangement of pump laser and PGx01 unit on optical table

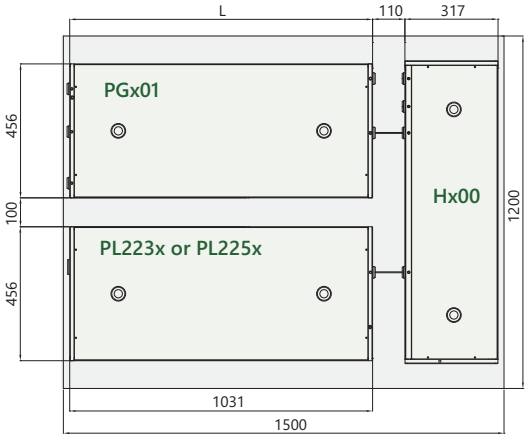

Fig 7. Recommended arrangement of pump laser and PGx01-DFGx unit on optical table

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OUTLINE DRAWINGS

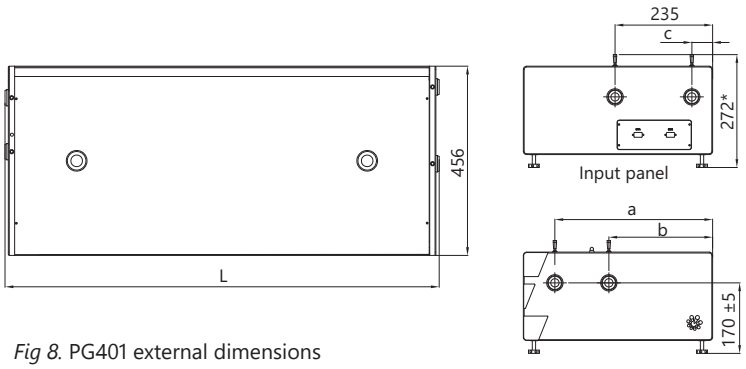

Fig 8. PG401 external dimensions

OUTPUTS PORTS

Model	L, mm	a, mm	b, mm	c, mm	Port 1	Port 2
PG401	633	380	×	×	420–680 nm, 740–2300 nm	–
PG401-SH	838	380	×	×	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

For SFG optional 532 nm output port 2.

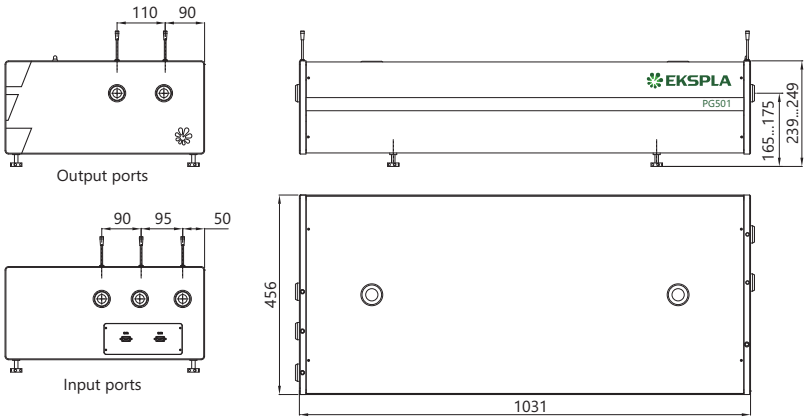

Fig 9. PG501 external dimensions

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 that 1 hour then laser (system) needs warm up for a few hours before switching on.

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 cm^{-1}***
- *Low divergence <2 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 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 3rd 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
PG403	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.
PG503	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.

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SPECIFICATIONS [1]

Model	PG403	PG403-SH	PG503
OPA SPECIFICATIONS			
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 [2]			
SH [3]	–	10 µJ	–
Signal	50 µJ		70 µJ
Idler [4]	15 µJ		25 µJ
Pulse repetition rate	1000 Hz		
Linewidth	< 12 cm^{-1}		
Typical pulse duration [5]	15 ps		20 ps
Scanning step			
SH	–	0.05 nm	–
Signal	0.1 nm		
Idler	1 nm		
Typical beam size [6]	~ 3 mm		
Beam divergence [7]	< 2 mrad		
Beam polarization [8]			
SH	–	horizontal	–
Signal	horizontal		
Idler	vertical		
PUMP LASER REQUIREMENTS			
Min pump energy [9]			
at 532 nm	–		0.45 mJ
at 355 nm	0.3 mJ		–
Pulse duration [10]	30 ps		
Beam size [10]	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
PHYSICAL CHARACTERISTICS			
Size (W × L × H)	456 × 820 × 273 mm		456 × 632 × 273 mm
OPERATING REQUIREMENTS			
Room temperature	15 – 30 °C		
Power requirements	100 – 240 V single phase, 47 – 63 Hz		
Power consumption	< 120 W		

1) 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.

2) Pulse energies are specified at selected wavelengths. See typical tuning curves for pulse energies at other wavelengths.

3) Measured at 250 nm.

4) Measured at 1000 nm.

5) Estimated assuming 30 ps at 1064 nm pump pulse. Pulse duration varies depending on wavelength and pump energy.

6) Beam diameter at the $1/e^2$ level. Can vary depending on the pump pulse energy.

7) Beam divergence measured at 450 nm.

8) Separate output ports for SH, signal and idler ranges.

9) Max pump energy is limited by available non-linear crystal sizes.

10) Should be specified while ordering if non-Ekspla pump laser is used.

TUNING CURVES

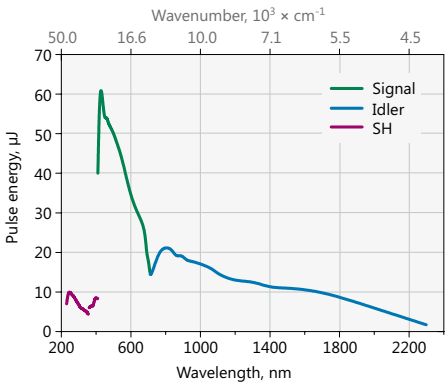

Fig 1. Typical PG403-SH model tuning curve.
Pump energy – 0.3 mJ at 355 nm

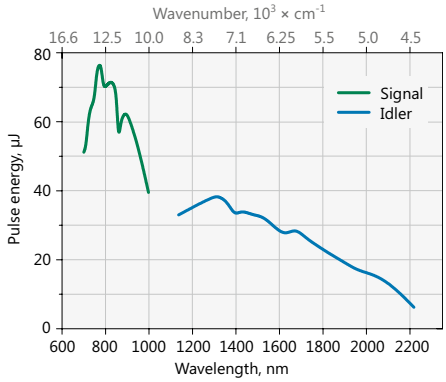

Fig 2. Typical PG503 model tuning curve.
Pump energy – 0.45 mJ at 532 nm

RECOMMENDED UNITS ARRANGEMENT ON OPTICAL TABLE

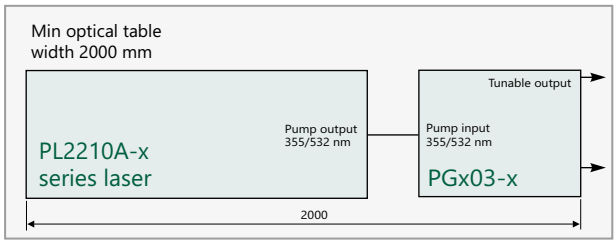

Fig 3. Arrangement of pump laser and PGx03 unit on optical table

OUTLINE DRAWINGS

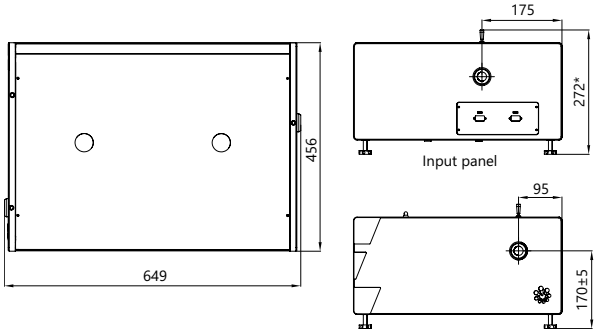

Fig 4. PGx03 model external dimensions

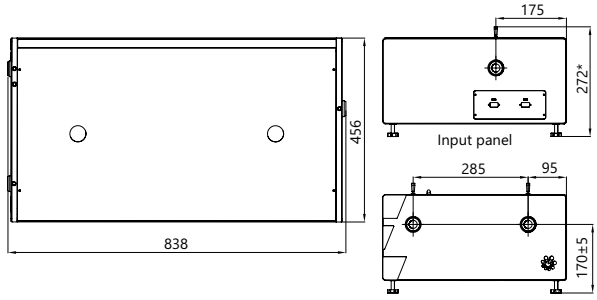

Fig 5. PGx03-SH model external dimensions

ORDERING INFORMATION

Note: Laser must be connected to the mains electricity all the time. If there will be no mains electricity for longer that 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