

PT403 SERIES



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 $< 9 \text{ cm}^{-1}$) at approximately 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 applications.

Simple and convenient laser control

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

Tunable Wavelength Picosecond Laser

FEATURES

- ▶ Tuning range: 210 – 2300 nm
- ▶ Motorized hands-free tuning
- ▶ High pulse energy at 1 kHz rates
- ▶ Diode pumped solid state design
- ▶ Narrow linewidth $< 9 \text{ cm}^{-1}$
- ▶ Remote control via keypad
- ▶ PC control
- ▶ Optional streak camera triggering pulse with $< 10 \text{ ps rms jitter}$
- ▶ Turn-key operation
- ▶ Air cooled – external water supply is not required
- ▶ Low maintenance costs

APPLICATIONS

- ▶ Time resolved fluorescence (including streak camera measurements), 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

SPECIFICATIONS ¹⁾

Model	PT403	PT403-SH
OPA SPECIFICATIONS		
Output wavelength tuning range		
SH	–	210 – 409 nm
Signal	410 – 709 nm	
Idler	710 – 2300 nm	
Output pulse energy ²⁾		
SH ³⁾	–	15 µJ
Signal ⁴⁾	> 75 µJ	
Idler ⁵⁾	> 25 µJ	
Pulse repetition rate	1000 Hz	
Linewidth	< 9 cm ⁻¹	< 12 cm ⁻¹
Typical pulse duration ⁶⁾	~ 20 ps	
Scanning step		
SH	–	0.05 nm
Signal	0.1 nm	
Idler	1 nm	
Typical beam size ⁷⁾	~ 2 mm	
Beam divergence ⁸⁾	< 2 mrad	
Beam pointing stability	≤ 100 µrad rms	
Beam polarization		
SH	–	horizontal
Signal	horizontal	
Idler	vertical	
Optical pulse jitter		
Internal triggering regime ⁹⁾	< 50 ps (StDev) in respect to TRIG1 OUT pulse	
External triggering regime	~ 3 ns (StDev) in respect to SYNC IN pulse	
TRIG1 OUT pulse delay ¹⁰⁾	-400 ... 150 ns	
OPERATING REQUIREMENTS		
Room temperature	22 ± 2 °C	
Relative humidity	20 – 80% (non-condensing)	
Power requirements	100 – 240 V single phase, 47 – 63 Hz	
Power consumption	< 0.6 kW	
Water service	air cooled	
Cleanness of the room	not worse than ISO Class 9	

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 260 nm.

⁴⁾ Measured at 450 nm.

⁵⁾ Measured at 1000 nm.

⁶⁾ Estimated assuming 30 ps at 1064 nm pump pulse. Pulse duration varies depending on wavelength and pump energy.

⁷⁾ Beam diameter at the 1/e² level. Can vary depending on the wavelength.

⁸⁾ Beam divergence measured at FWHM.

⁹⁾ < 10 ps jitter is provided with PRETRIG option.

¹⁰⁾ TRIG1 OUT lead or delay can be adjusted with 0.25 ns steps in specified range.



Communication module interfaces

Interface	Description
USB *	REST API over RNDIS
RS232	ASCII commands
LAN	REST API

* Default, other option: ASCII commands over virtual serial port

DESIGN

The units can be divided into several functional parts:

1. 1 kHz repetition rate DPSS pump laser,
2. Optical parametric generator (OPG),
3. Electronic control unit.



Fig 1. PT403 unit

PT403 series laser systems integrate a picosecond 1 kHz repetition rate DPSS pump laser and optical parametric generator into a single housing. As pump laser is used PL2210 series diode-pumped, air-cooled, mode-locked Nd:YAG laser. Picosecond tunable wavelength laser system provide from 210 to 2300 nm from the single optical unit.

OPTIONS

► **Option SF**

Energy increasing in 300 – 409 nm range by sum-frequency generation. > 20 µJ @ 340 nm. Pulse energies are ~ 10 % lower in comparison to the system without SF option. See table below for pulse energy specifications:

Model ¹⁾	PT403	PT403-SH
SH ²⁾	–	> 13 µJ
Signal ³⁾		> 70 µJ
Idler ⁴⁾		> 22 µJ

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.

²⁾ Measured at 260 nm.

³⁾ Measured at 450 nm.

⁴⁾ Measured at 1000 nm.

► **Options -H, -2H, -3H**

1064 nm or 532 nm, or 355 nm outputs ^{1) 2)}

- H output energy 0.7 mJ;
- 2H output energy 0.3 mJ;
- 3H output energy 0.3 mJ.

¹⁾ Outputs are not simultaneous.

²⁾ Inquire for outputs simultaneously with PG.

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.

TUNING CURVES

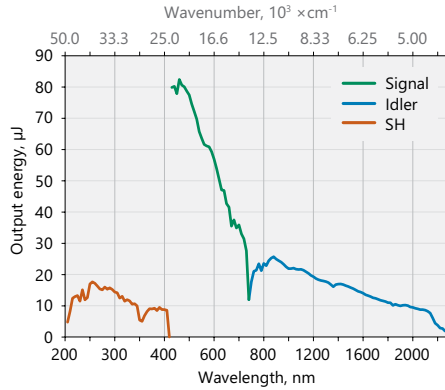


Fig 2. Typical PT403 tuning curves in signal (410 – 709 nm), idler (710 – 2300 nm) ranges, SH (210 – 409 nm) ranges

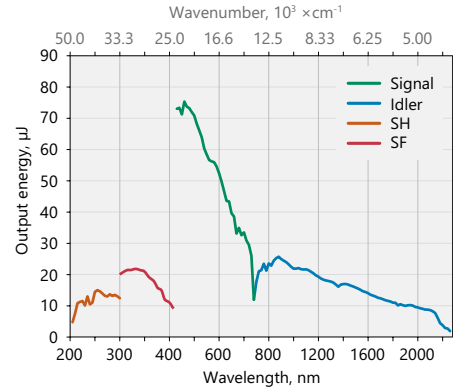


Fig 3. Typical PT403 tuning curves in signal (410 – 709 nm), idler (710 – 2300 nm) ranges, SH (210 – 300 nm), SF (300 – 409 nm) ranges

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

OUTLINE DRAWINGS

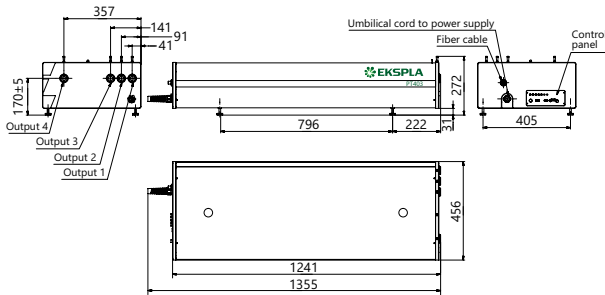


Fig 4. PT403 series laser head typical outline drawing

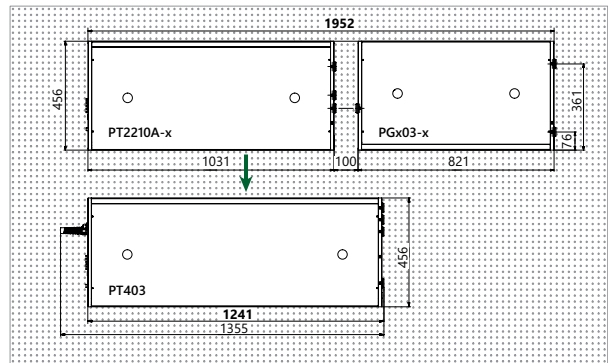


Fig 5. Compared with layout where laser and OPO are in different units, PT403 features almost twice smaller footprint

OUTPUTS PORTS

Model	L, mm	Port 1	Port 2	Port 3	Port 4
PT403	1241	1064 / 532 nm	–	355 nm	410 – 2300 nm
PT403-SH/SF	1441	1064 / 532 nm	210 – 2300 nm	355 nm	410 – 2300 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.


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PT277 SERIES



PT277 series laser systems integrate a picosecond optical parametric oscillator (OPO) and a pump laser in a single compact housing. Mounting the components on the same frame provides a robust solution. It makes laser installation shorter, improves long-term stability, and reduces maintenance costs.

The laser is hermetic and has an internal air cleaning system to clean from water vapor and organics, making it an excellent source for spectroscopic applications.

Nearly diffraction-limited divergence and beam-direction stability throughout the entire spectral tuning range are essential in tunable radiation applications requiring high-precision laser beam focusing.

Fast and fully automatic wavelength tuning is achieved by advanced microprocessor control. The wavelength tuning elements are mounted on precise closed-loop micro-stepping motors. The temperatures of the nonlinear crystals are controlled by precise thermo-controllers. No additional manual adjustment of the laser system is needed.

For customer convenience, the laser can be operated from a master device or a personal computer using various interfaces. Depending on the system configuration, control is available via the USB interface (REST API over RNDIS or VCP with ASCII commands), the RS-232 interface (ASCII commands), the LAN interface (REST API), or from the remote control

Single Housing Mid-Infrared Tunable Picosecond Laser System

FEATURES

- ▶ **Tuning range 1403 – 17000 nm (7127 – 589 cm⁻¹)**
- ▶ **Hands-free tuning:** motorized for the entire tuning range
- ▶ **Linewidth <4 cm⁻¹** in the entire tuning range
- ▶ **Nearly diffraction limited divergence**
- ▶ **Beam direction stability in the entire tuning range**
- ▶ **Single housing:** integrates a pump laser and OPO in a single housing
- ▶ **Internal air cleaning system**
- ▶ **PC control via USB (virtual COM port), RS232, LAN using REST API commands**
- ▶ **Fast wavelength scan (sweep)**

APPLICATIONS

- ▶ **Infrared spectroscopy**
- ▶ **SNOM (scanning near field microscopy)**

pad with a backlit display that remains easy to read even while wearing laser safety glasses.

PT277 series features two models

Model	Features
PT277-SI	provides a narrowband radiation with a linewidth <4 cm ⁻¹ in the entire tuning range: 1403 – 2020 nm (7127 – 4951 cm ⁻¹) 2250 – 4400 nm (4444 – 2273 cm ⁻¹)
PT277-XIR	provides a narrowband radiation with a linewidth <4 cm ⁻¹ in the entire tuning range: 1403 – 2020 nm (7127 – 4951 cm ⁻¹) 2250 – 4400 nm (4444 – 2273 cm ⁻¹) 5000 – 17000 nm (2000 – 589 cm ⁻¹) *

* Inquire about the available spectral range.

SPECIFICATIONS ¹⁾

Parameter	PT277-SI	PT277-XIR
OUTPUT SPECIFICATIONS		
Tuning range		
Signal	1403 – 2020 nm (7127 – 4951 cm ⁻¹)	
Idler	2250 – 4400 nm (4444 – 2273 cm ⁻¹)	
DFG	–	5000 – 17000 nm (2000 – 589 cm ⁻¹) ²⁾
Output power ³⁾		
@ 1403 – 2020 nm (Signal)	> 400 mW	
@ 2250 – 4000 nm (Idler)	> 100 mW	
@ 12500 nm (DFG)	–	> 10 mW
@ 17000 nm (DFG)	–	> 3 mW
Linewidth	< 4 cm ⁻¹	
Pulse repetition rate	~ 87 MHz (same as that of the pump laser)	
Pulse duration	~8 ps	
Typical beam diameter ⁴⁾ (at 1/e ² level)	~ 3 mm @ 3000 nm	
Typical beam divergence ⁵⁾	< 5 mrad @ 1600 nm	
Beam pointing stability	< 50 μrad rms @ 1600 nm	
Polarization		
Signal and idler	linear, vertical	
DFG	–	linear, vertical
Fast spectral scan speed for spectral range		
From 1403 to 2020 nm (Signal)	< 4 s	
From 2250 to 4400 nm (Idler)	< 4 s	
From 12500 to 16000 nm (DFG)	–	< 2 s
Output power modulation frequency (AOM)	0 Hz – 2 MHz	
PHYSICAL CHARACTERISTICS		
Laser unit size (W×L×H)	320 × 766 × 241 mm	
Power supply size (W×L×H)	483 × 140 × 390 mm , stand-alone	
Chiller (third-party, approx.) (W×L×H)	290 × 420 × 290 mm , stand-alone	
Umbilical length	2.5 m	
SERVICE AND OPERATION REQUIREMENTS		
Cooling	water-air	
Room temperature	22 ± 2 °C	
Room temperature stability	± 1 °C	
Relative humidity	< 80 % (non-condensing)	
Power requirements	100 – 240 VAC (-10% / +5%), single phase, 50/60 Hz	
Power consumption	< 1 kW	
Cleanness of the room	not worse than ISO Class 9	

¹⁾ All specifications are subject to change without notice. The parameters given in the table are indicators of the typical performance of the laser system. They may vary with each manufactured laser system.

²⁾ Inquire about the available spectral range.

³⁾ Output powers are specified at selected wavelengths. See typical tuning curves for power at other wavelengths. Power drops are possible.

⁴⁾ May vary depending on pump pulse energy.

⁵⁾ Full angle at FWHM level.

Note: The laser must be connected to the mains electricity all the time. If there will be no mains electricity for longer than 1 hour then the laser system needs to warm up for a few hours before switching radiation on. The laser and auxiliary units must be installed in a place free from dust and aerosols. It is advisable to operate the laser in an air-conditioned room and to place the laser at a distance from air conditioning outlets. The laser should be positioned on a solid optical table. Access from both sides should be ensured. Intense sources of vibrations like freight elevators, railway stations, etc. should be avoided nearby.



Communication module interfaces

Interface	Description
USB*	REST API over RNDIS
RS232	ASCII commands
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* Default, other option: ASCII commands over virtual serial port

TUNING CURVES

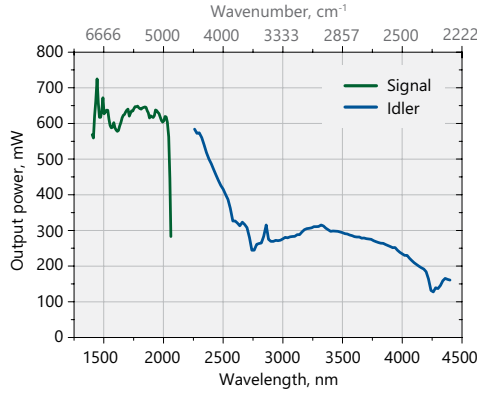


Fig 1. Typical PT277-SI laser system output tuning curve.
The actual tuning curve might differ from presented here.

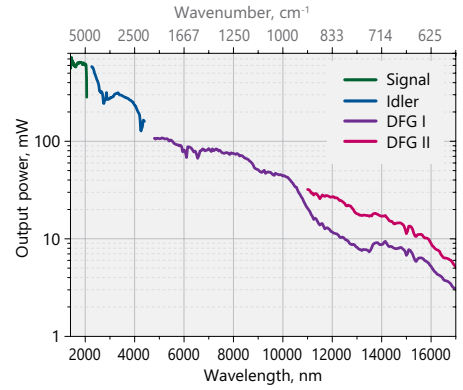


Fig 2. Typical PT277-XIR laser system output tuning curve.
DFG I range – for wide tuning range.
DFG II – for higher power at longer waves.
The actual tuning curve might differ from presented here.

OPTIONS

- ▶ **Option -H**
1064 nm output, <0.5 W at 1064 nm output power.
- ▶ **Option -18000**
Tuning range, DFG: 5000 – 18000 nm (2000 – 556 cm⁻¹)

ACOUSTO-OPTIC MODULATOR AOM

An acousto-optic modulator AOM is used for the output pulse train modulation in the 0–2 MHz frequency range.

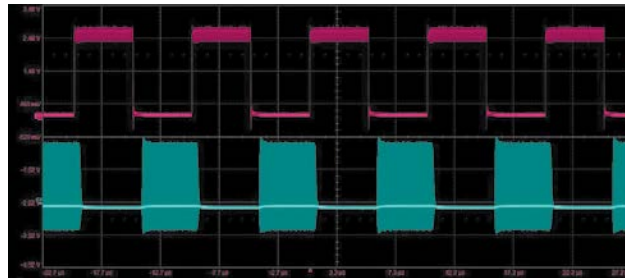


Fig 3. AOM control example:
magenta – 100 kHz control TTL signal to AOM CONTROL;
cyan – optical signal

OUTLINE DRAWINGS



Fig 4. PT277-SI laser features the same external housing as PT277-XIR.
PT277-XIR and PT277-SI lasers feature easy attachable handles that enable easy transportation and installation

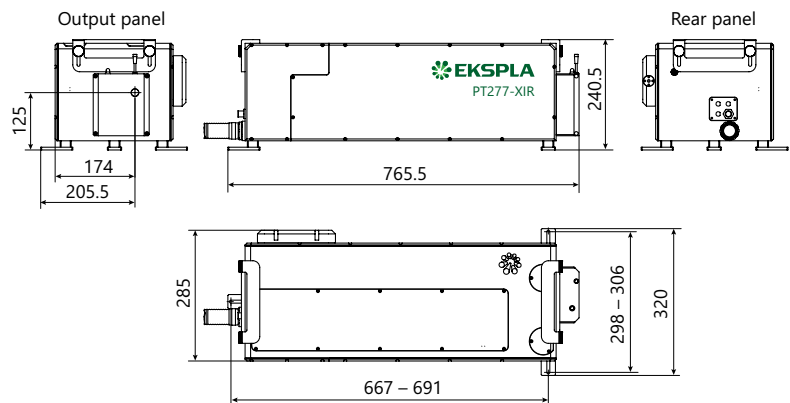


Fig 5. External dimensions of PT277-XIR and PT277-SI laser units (the same external housing)