



## Origami

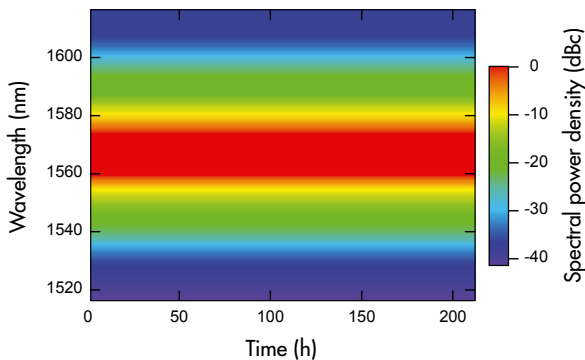
### Ultra-low noise femtosecond laser module

Swiss  
Made



The lowest  
phase noise  
on the market

Origami is the industrial-grade, ultra-compact, mode-locked, femtosecond laser that provides the lowest phase noise and timing jitter available on the market. It has been specifically designed for OEM integration. Origami laser emits transform-limited soliton pulses, provides diffraction-limited beam quality and excellent pointing stability. It is available at various wavelengths and repetition rates. Origami is an air-cooled, maintenance-free laser module packaged in a sealed, robust enclosure allowing for operation in the harshest environments. It guaranties high stability, low drift and 24/7 operation.



Optical spectrum as function of time

#### Laser outstanding features:

- Lowest phase noise on the market
- Transform-limited clean soliton pulses
- Diffraction-limited beam quality
- No Kelly sidebands, no spectral ripple
- Shot noise limited relative intensity noise
- Maintenance free – no alignment required
- Plug & Play
- 24/7 operation

#### Options:

- Synchronization to external clock for ultra-low timing jitter
- Analog pump power control
- Repetition rate control and tunability
- Carrier-Envelope-Phase (CEP) stabilization ready
- Fiber output (PM of SM)

#### Main applications:

- Seed for amplifiers
- Frequency Comb systems
- Supercontinuum generation
- Analog-to-Digital converters/Radar systems
- Clock distribution
- THz generation

| Laser specifications                   | Origami - 05   | Origami - 08        | Origami - 10          | Origami - 15          | Origami - 17          |
|--|--|---------------------|-----------------------|-----------------------|-----------------------|
| Center wavelength                      | <b>513 – 535 nm</b>                                      | <b>765 – 785 nm</b> | <b>1025 – 1070 nm</b> | <b>1530 – 1580 nm</b> | <b>1580 – 1700 nm</b> |
| Pulse Duration <sup>1,2</sup>          | <100 – 230 fs  | <60 – 200 fs        | <70 – 400 fs          | <80 – 500 fs          | <200 – 300 fs         |
| Avg. output power (up to) <sup>2</sup> | 100 mW   | 30 mW               | 250 mW                | 120 mW                | 50 mW                 |
| Pulse energy (up to) <sup>2</sup>      | 1.2 nJ   | 0.7 nJ              | 5 nJ                  | 2 nJ                  | 1 nJ                  |
| Peak power (up to) <sup>2</sup>        | 10 kW  | 4.5 kW              | 30 kW                 | 15 kW                 | 3 kW                  |
| Pulse repetition rate <sup>2</sup>     | 20 MHz – 1.3 GHz   |                     |                       |                       |                       |
| Spectral bandwidth                     | transform-limited ( $\tau_p \cdot \Delta\nu \sim 0.32$ ) |                     |                       |                       |                       |
| Beam quality                           | $M^2 < 1.1$ , TEM <sub>00</sub>                          |                     |                       |                       |                       |
| PER                                    | > 23 dB  |                     |                       |                       |                       |
| Amplitude noise (24 h)                 | < 0.2% rms, <0.5% pk-pk                                  |                     |                       |                       |                       |
| Center wavelength drift                | < 0.1 nm pk-pk   |                     |                       |                       |                       |
| Laser output                           | collimated free space (fiber output optional)            |                     |                       |                       |                       |
| <b>Environmental</b>                   |  |                     |                       |                       |                       |
| Warm-up time                           | < 10 minutes   |                     |                       |                       |                       |
| Operation temperature                  | 10°C – 40°C  |                     |                       |                       |                       |
| Storage temperature                    | -20°C – 65°C   |                     |                       |                       |                       |
| On/Off cycles                          | > 10000  |                     |                       |                       |                       |
| <b>Mechanical</b>                      |  |                     |                       |                       |                       |
| Size laser head <sup>3</sup>           | 296 x 112 x 54 mm <sup>3</sup>                           |                     |                       |                       |                       |
| Weight laser head <sup>3</sup>         | 2.5 kg   |                     |                       |                       |                       |
| Size control unit <sup>3</sup>         | 165 x 104 x 44 mm <sup>3</sup>                           |                     |                       |                       |                       |
| Weight control unit <sup>3</sup>       | 0.65 kg  |                     |                       |                       |                       |
| <b>Electrical</b>                      |  |                     |                       |                       |                       |
| Power supply                           | 24VDC/2.5A or 90 – 264 VAC, 47 – 63 Hz                   |                     |                       |                       |                       |
| Power consumption                      | < 15 W   |                     |                       |                       |                       |
| <b>Cooling</b>                         |  |                     |                       |                       |                       |
| Laser head                             | air cooled   |                     |                       |                       |                       |
| Laser controller                       | air cooled   |                     |                       |                       |                       |



### IEC Compliant Product

IEC 60068-2-27:2008  
IEC 60068-2-6:2007  
Shock & Vibration Test  
  
IEC 61010-1:2010  
IEC 61326-1:2012  
Electromagnetic  
Compatibility  
  
IEC 60825-1:2014  
Laser Radiation Safety

### ISO Certified Company

ISO 9001:2008  
ISO 13485:2012

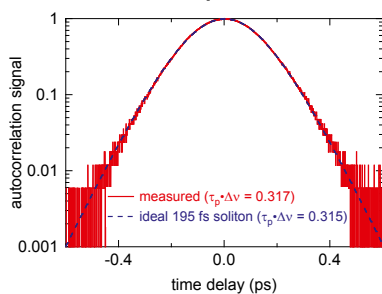


<sup>1</sup> Tunable (requires external adjustable power supply)

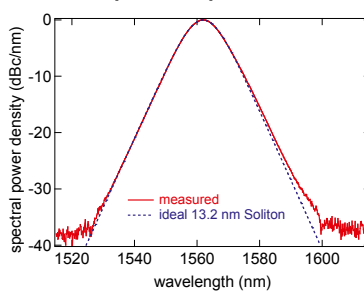
<sup>2</sup> Please inquire for possible combinations of pulse duration, average power and repetition rate

<sup>3</sup> Exact size and weight depend on pulse repetition rate and wavelength

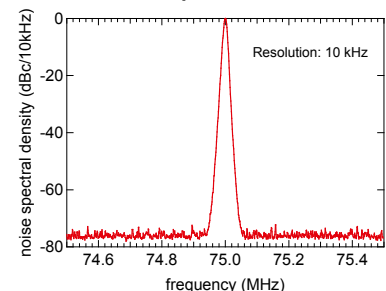
### Pulse profile



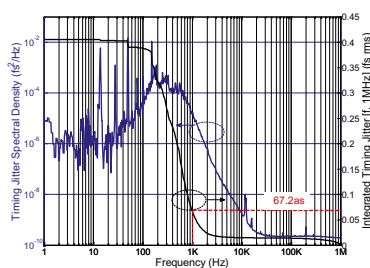
### Optical spectrum



### RF spectrum

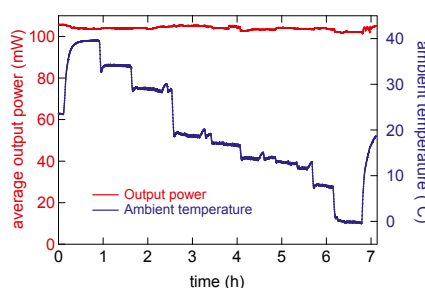


### Phase noise / Timing jitter



M. Y. Peng et Al. – Proceedings of FEL 2013

### Temperature cycling



### Supercontinuum generation

