

# Spirit-NOPA<sup>®</sup>

## HIGH REPETITION RATE AUTOMATED NON-COLLINEAR OPTICAL PARAMETRIC AMPLIFIERS

### The Spirit-NOPA Advantage

- High repetition rate, sub-30 fs pulses
- Wide wavelength range from UV to IR
- Peak powers up to >10 MW in the IR
- Spectral bandwidth and pulse duration control
- Integrated pulse compressor
- Computer controlled operation
- Optional built-in output SHG



The Spirit-NOPA<sup>®</sup> is a family of automated non-collinear optical parametric amplifiers (NOPA) specifically built and optimized for the Spirit<sup>®</sup> and Spirit<sup>®</sup> One<sup>™</sup> ultrafast lasers. The turn-key, high repetition rate Spirit femtosecond laser combines with the Spirit-NOPA to create a powerful, user-friendly tunable source of ultrashort pulses for high repetition rate ultrafast applications.

### Spirit-NOPA is available in four configurations:

The Spirit-NOPA-2H includes a built-in second harmonic generator, to convert the Spirit IR beam to 520 nm. The output of the Spirit-NOPA-2H is tunable from 650 to 900 nm with pulse width as short as sub-25 fs and an output energy up to >3  $\mu$ J.

Spirit-NOPA-3H includes a built-in third harmonic generator and its output is tunable from 500 to 800 nm with a pulse width as short as sub-25 fs and an output energy up to >0.5  $\mu$ J.

Spirit-NOPA-IR includes a built-in second harmonic generator and its output is tunable from 1200 to 1600 nm with a pulse width as short as sub-50 fs, an output energy up to >0.6  $\mu$ J, and peak powers up to >10 MW.

Spirit-NOPA-VISIR provides a broad tuning range of 650 nm to 900 nm (signal) and 1200 nm to 2500 nm (idler). The Spirit-NOPA-VISIR comprises two amplification stages seeded by white-light continuum and pumped by the second harmonic of the Spirit. The first amplification stage is non-collinear, which generates broad bandwidth, and the second amplification stage is collinear, which generates the broad tuning range. The signal output can be compressed to <70 fs using an external prism-based compressor unit, and the idler output to <100 fs, using a bulk compressor integrated into the housing.

Spirit-NOPA is fully computer controlled to allow for easy wavelength tunability. Its built-in bandwidth selector and integrated computer controlled compressor provide a pulse width agility unmatched by other ultrafast laser technologies.

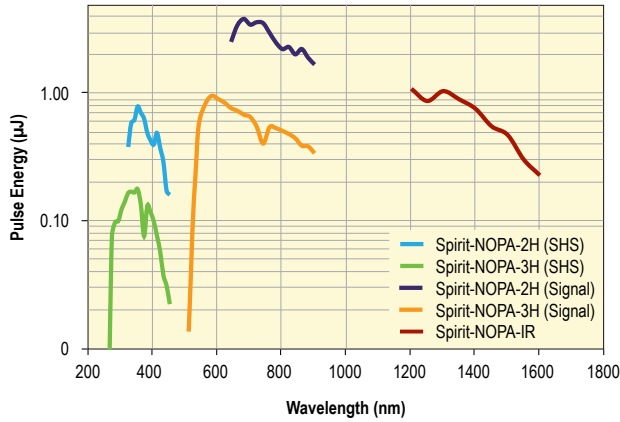
Spirit-NOPA can be factory optimized for a wide range of pump pulse energies to allow for multi-color high repetition rate experiments.

### Applications

- Single molecules studies
- 3-photon excitation microscopy
- Nanomaterials science
- Ultrafast surface dynamics
- Multi-dimensional spectroscopy

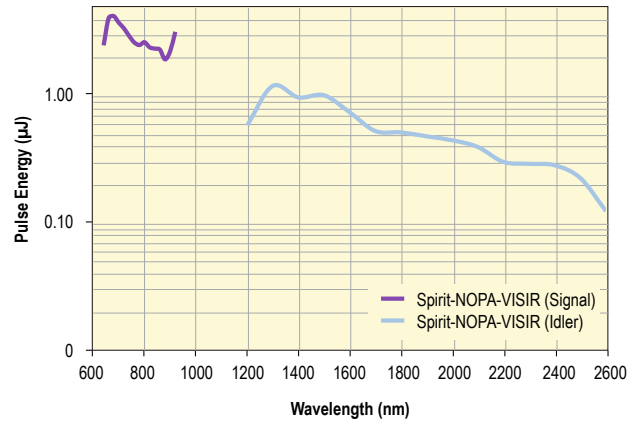
# Spirit-NOPA<sup>®</sup>

**Typical Spirit-NOPA Performance<sup>1</sup>**  
(Spirit pump pulse energy 40  $\mu$ J, compressed output)



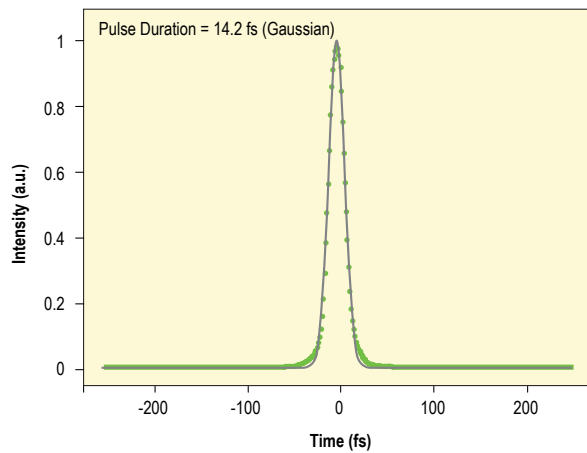
1. Typically measured performance; not a guaranteed or warranted specification.

**Typical Spirit-NOPA-VISIR Performance<sup>1</sup>**  
(Spirit pump pulse energy 40  $\mu$ J, compressed output)



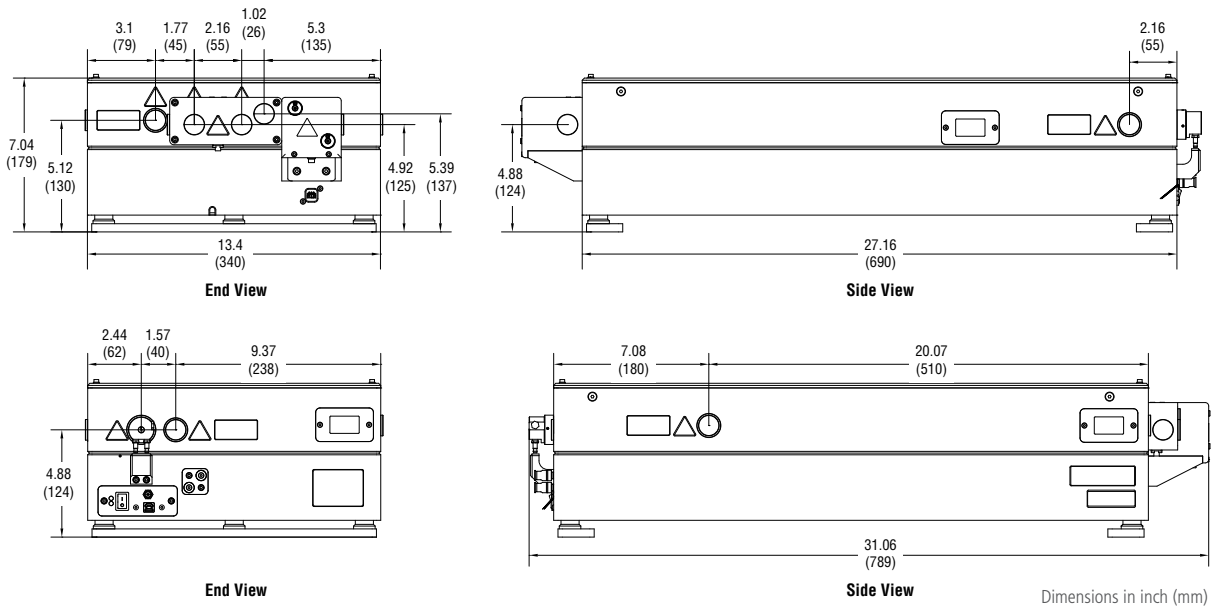
1. Typically measured performance; not a guaranteed or warranted specification.

**Typical Spirit-NOPA Pulse Duration<sup>1</sup>**



1. Typically measured performance; not a guaranteed or warranted specification.

## Spirit-NOPA Dimensions



## Specifications<sup>1</sup>

	Spirit-NOPA-3H	Spirit-NOPA-2H	Spirit-NOPA-IR
<b>Output Specifications</b>			
Optional Pump Harmonic Output Energy	>10 µJ at 347 nm	>20 µJ at 520 nm	>20 µJ at 520 nm
Tuning Range	500–900 nm	650–900 nm	1200–1600 nm
Pulse Energy <sup>2</sup>	0.5 µJ at 580 nm (peak); 0.25 µJ at 700 nm	3 µJ at 700 nm (peak); 1.2 µJ at 850 nm	0.6 µJ at 1300 nm; 0.3 µJ at 1500 nm
Pulse Width	<30 fs at 530–670 nm; <80 fs at 670–800 nm	<30 fs at 700–850 nm	<80 fs at 1200–1600 nm
<b>Optional SHG Output</b>			
Tuning Range	250–450 nm	325–450 nm	600–800 nm
Pulse Energy <sup>2</sup>	0.05 µJ at 290 nm (peak)	0.3 µJ at 350 nm (peak)	0.06 µJ at 650 nm
<b>Pump Requirements<sup>4</sup> from Spirit</b>			
Wavelength	1040 nm		
Pulse Energy <sup>5</sup>	8–120 µJ		
Max. Input Power	8 W	6 W	16 W
Pulse Width (typical)	350 fs		

Spirit-NOPA-VISIR	
<b>Output Specifications</b>	
Optional Pump Harmonic Output Energy	>20 µJ at 520 nm
Tuning Range	650–900 nm (signal) 1200–2500 nm (idler)
Conversion Efficiency	>10% at peak, when pumped at >20 µJ >5% at peak, when pumped at 8–20 µJ (uncompressed signal + idler combined)
Pulse Width <sup>3</sup>	<350 fs uncompressed <sup>3</sup> 25–70 fs at 650–900 nm; 40–100 fs at 1200–2000 nm
Compressor Transmission	Signal prism compressor: 50–70% at 700–900 nm Idler bulk compressor: 70–80% at 1200–2000 nm
<b>Optional SHG Output</b>	
Tuning Range	325–450 nm (SH of signal) 600–700 nm (SH of idler)
Pulse Energy	>10% of signal/idler at peak
<b>Pump Requirements<sup>4</sup> from Spirit</b>	
Wavelength	1040 nm
Pulse Energy <sup>5</sup>	8–120 µJ
Max. Input Power	30 W
Pulse Width (typical)	350 fs

1. Due to our continuous product improvement program, specifications are subject to change without notice.

2. When pumped with 40 µJ at 1040 nm. For other pump levels, please contact the factory.

3. Compressors for signal and/or idler are optionally included.

4. Spirit-NOPA pump parameters are determined at the time of order and are set at factory.

5. Spirit-NOPA is optimized for one pump pulse energy only.