



## TEMA-DUO. Yb-doped Solid-State Femtosecond Oscillator with Built-in SHG

- 2 wavelengths (1050/525 nm)
- Up to 3 W average power at 525 nm
- Pulse duration as short as <100 fs
- Monolithic highly stable thermally stabilized body
- Built-in direct diode pump source
- TOPOL parametric oscillator extension (option)
- Capable of pumping Ti:S and Cr:F oscillators (TiF, CrF, Tricolor)



TEMA-DUO-100 femtosecond laser with customized feet

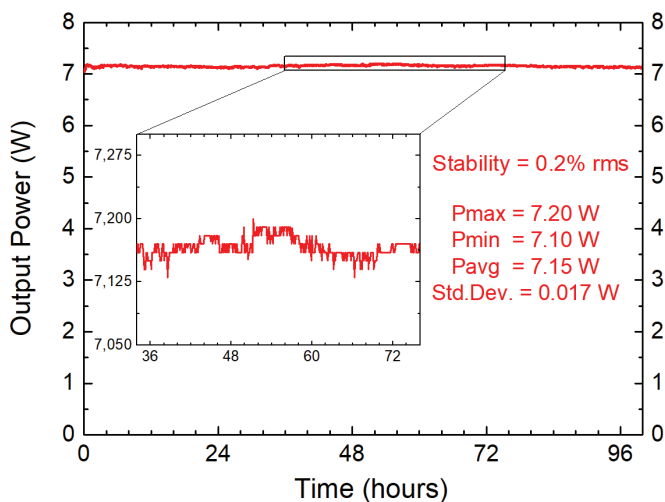
### Product overview

The TEMA laser based on an Yb-doped crystal radiates at around 1-um wavelength with high average power, enabling the user to enjoy high power ratings at over-micron wavelengths. This design features an integrated pump diode module for greater system stability and turn-key operation. The monolithic thermally stabilized body of the laser ensures maximum rigidity, while self-starting design provides for easy "plug-and-play" operation.

The TEMA-DUO is a further development of the TEMA Yb solid-state laser platform incorporating a built-in second harmonic generation module. Short pulse duration and high average power of the fundamental radiation allow reaching SHG conversion efficiency over 40%.

The TEMA-DUO is available in two basic models: the TEMA-DUO-100 and the TEMA-DUO-150. The main difference between the two is the difference in output pulse duration: <100 fs for the TEMA-DUO-100 and <150 fs for the TEMA-DUO-150. The TEMA-DUO system comprises the pump diode assembly with compact control and monitoring unit, the laser cavity and special optical routing layout that allows getting either full power of the fundamental beam, or two simultaneous outputs at 1050 and 525 nm. The fundamental and SH pulses have the same repetition rates and the pulse trains are completely in sync. Two synchronous outputs of the TEMA-DUO provide the capability for nonlinear optics research with high temporal resolution in a single budget-friendly system.

High output power of the SHG in the visible range opens up the possibility to use the TEMA-DUO as an effective pump source for parametric oscillators (such as the TOPOL systems), as well as for Ti:Sapphire pumping (the Tricolor multichannel system), replacing the pricey CW DPSS pump lasers while providing additional femtosecond channel of optical radiation in the visible range. It is also possible to use the fundamental beam to pump and additional Cr:F femtosecond Cr:F laser system. Thus, possible laser combinations are rather flexible and may be requested on custom basis.



Long-term power stability testing of the TEMA-DUO system at 1050 nm output (<0.2% rms) over 96 hours uninterrupted operation

### Possible applications of the TEMA-DUO laser:

- Two-photon polymerization
- OPO pumping
- Ti:S and Cr:F laser pumping
- High average power THz generation
- Multi-photon excitation microscopy
- Pump-probe spectroscopy
- Supercontinuum generation
- Time-resolved spectroscopy
- Optical coherent tomography



**AVESTA**  
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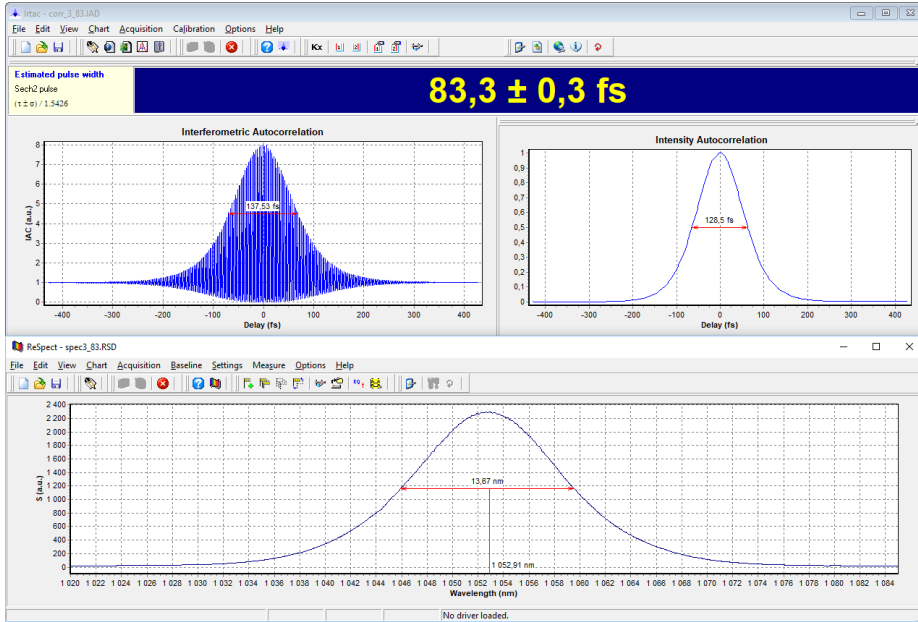
	TEMA-DUO-100		TEMA-DUO-150	
Central wavelength	1050 nm	525 nm	1050 nm	525 nm
Output average power	>5 W	>2 W	>7 W	>3 W
Output pulse duration <sup>1)</sup>	<100 fs		<150 fs	
Pulse repetition rate (fixed)	80 +/- 2 MHz			
Pulse energy	>60 nJ	>25 nJ	>85 nJ	>35 nJ
Peak power	>520 kW	>220 kW	>500 kW	>200 kW
Beam mode	TEM <sub>00</sub>			
M <sup>2</sup>	<1.2			
Beam diameter (at 1/e <sup>2</sup> ) 1050 nm	1+/-0.2 mm			
Beam diameter (at 1/e <sup>2</sup> ) 525 nm	2+/-0.2 mm			
Output polarization at 1050 nm	linear, horizontal			
Output polarization at 525 nm	linear, vertical			
Beam divergence at 1050 nm	<1.8+/-0.3 mrad			
Beam divergence at 525 nm	<0.5+/-0.1 mrad			
Beam asymmetry at 525 or 1050 nm	<15%			
Beam astigmatism at 525 or 1050 nm	<15%			
Long-term stability <sup>2)</sup>	<0.3% rms			
Cold start warm-up time	<20 min			
<b>Cooling requirements</b>				
Laser head	closed-loop chiller included			
Power supply	air cooled			
<b>Physical dimensions (L x W x H)</b>				
Laser head dimensions	490 x 260 x 97 mm			
Laser control unit dimensions	290 x 200 x 80 mm			
Closed-loop chiller dimensions	430 x 340 x 190 mm			
Umbilical length	1.8 m			
<b>Environmental and utility specifications</b>				
Operating temperature	18-28 °C			
Relative humidity	<60%, non-condensing			
Voltage	single-phase; 100-240 VAC; 50/60 Hz			
Power consumption	<1 kW			
1) - a sech <sup>2</sup> pulse shape is used to determine the pulse duration. Measured with Avesta AA-20DD interferometric autocorrelator; 2) - after 30 min warm-up with cold start, during 12-hour continuous operation under equal room temperature conditions using recommended stabilized closed-loop chiller with proper capacity.				



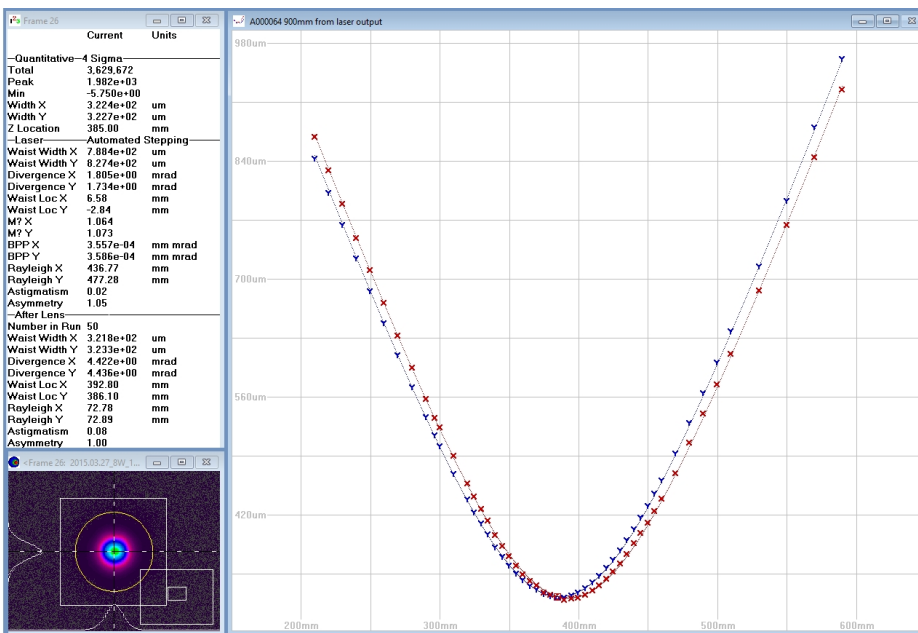
Switchable output of the TEMA-DUO-100 femtosecond laser (fundamental only or simultaneous fundamental and SHG)



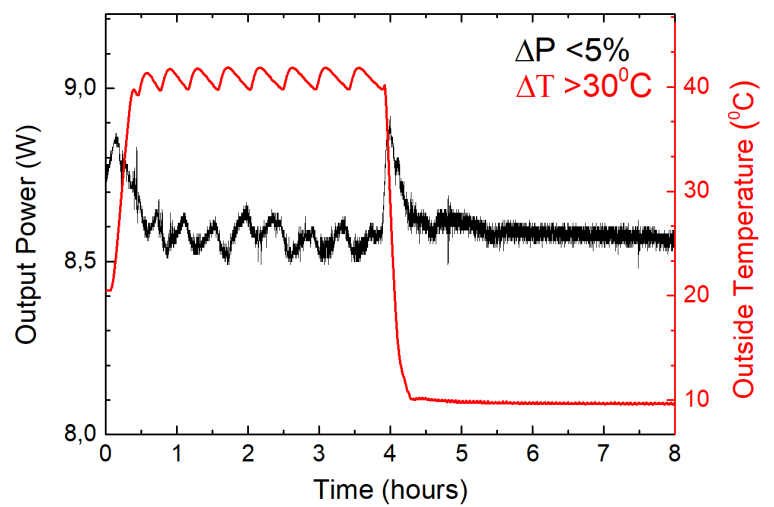
Compact TEMA control and monitoring unit



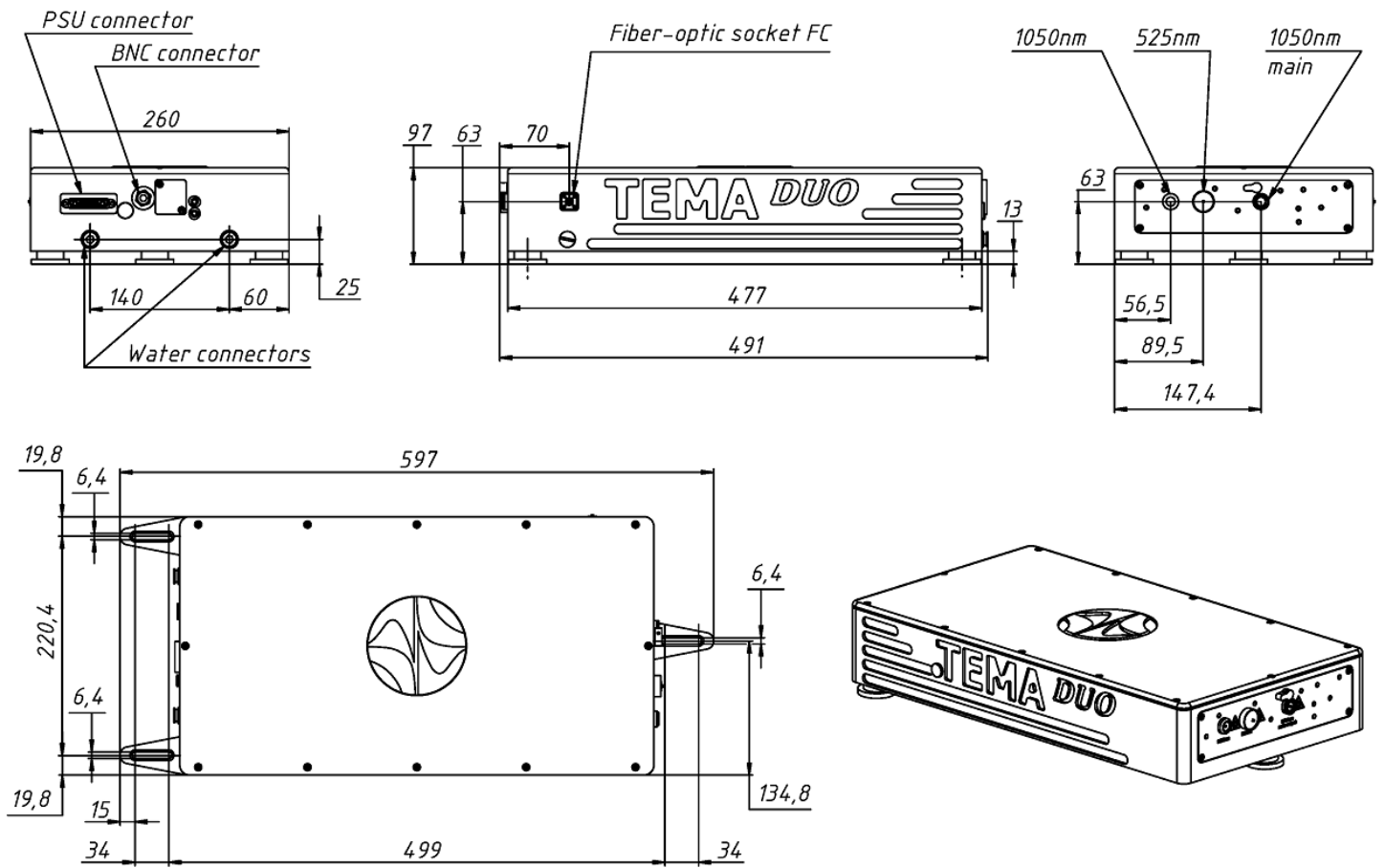
Typical AC traces and spectrum of a TEMA laser system



Typical M<sup>2</sup> of a TEMA series laser system



Thermal cycling of a TEMA system within 10...40 °C temperature span



Dimensions of a TEMA-DUO series laser head in mm