

# NL230 SERIES



The NL230 series diode-pumped Q-switched lasers produce up to 100 mJ at 100 Hz or up to 140 mJ at 30 Hz pulse repetition rate. Diode pumping allows maintenance-free laser operation for an extended period of time (more than 3 years for an estimated eight working hours per day). The typical pump diode lifetime is more than 1 billion shots.

Lasers are designed to produce high-intensity, high-brightness pulses and are targeted for applications such as material ablation, remote sensing, OPO, Ti:Sapphire or dye laser pumping. Due to an electro-optical Q-switch, the master oscillator generates short duration pulses in the 5–9 ns range. The oscillator cavity optical design features a variable-reflectivity output coupler, giving a low-divergence laser beam.

A closed-loop TEC based chiller is used for laser cooling, eliminating the need for external cooling water and reducing running costs.

OEM version of NL230 series laser features compact design and stable output parameters

Angle-tuned non-linear crystals mounted in temperature stabilized heaters are used for optional second, third or fourth harmonic generation. The harmonics separation system is designed to ensure radiation with a high spectral purity and to direct it to the separate output ports.

For customer convenience the laser can be controlled via a user-friendly remote control pad or a USB interface. The remote pad allows easy control of all parameters and features a backlit display that is easy to read even through laser safety eyewear. Alternatively, the laser can be controlled from a personal computer via supplied Windows™ compatible software. LabVIEW™ drivers are also included with each laser installation package.



## High Pulse Energy Q-switched DPSS Nd:YAG Lasers

### FEATURES

- ▶ Diode-pumped, typical diode lifetime >1 Gshot
- ▶ Up to **150 mJ** at **1064 nm** pulse energy
- ▶ Up to **100 Hz** pulse repetition rate
- ▶ Variable repetition rate version featuring 0...50 Hz range is available
- ▶ Short pulse duration in the **5–9 ns** range
- ▶ Variable reflectivity output coupler for low-divergence beam
- ▶ Quiet operation: no more flashlamp firing sound
- ▶ Remote control via keypad and/or PC via USB (RS232 optional) port with supplied LabVIEW™ drivers
- ▶ Optional temperature-stabilized second, third and fourth harmonic generators

### APPLICATIONS

- ▶ OPO, Ti:Sapphire and dye laser pumping
- ▶ TFT-LCD Repair
- ▶ Mass Spectroscopy
- ▶ Remote Sensing
- ▶ LIDAR (Light Detection And Ranging)
- ▶ LIF (Light Induced Fluorescence)
- ▶ PIV (Particle Image Velocimetry)
- ▶ LIBS (Light Induced Breakdown Spectroscopy)
- ▶ ESPI (Electronic Speckle Pattern Interferometry)
- ▶ Medical
- ▶ LIBS (Laser-induced Breakdown Spectroscopy)
- ▶ Photo acoustic imaging

SPECIFICATIONS <sup>1)</sup>

Model	NL230	NL231	NL232	NL233
Pulse energy				
at 1064 nm	50 mJ	150 mJ	140 mJ	100 mJ
at 532 nm <sup>2)</sup>	20 mJ	70 mJ	60 mJ	50 mJ
at 355 nm <sup>3)</sup>	12 mJ	35 mJ	35 mJ	35 mJ
at 266 nm <sup>4)</sup>	4 mJ	15 mJ	12 mJ	10 mJ
Pulse to pulse energy stability (rms) <sup>5)</sup>				
at 1064 nm	<1.5 %		<1 %	
at 532 nm	<3.5 %		<2.5 %	
at 355 nm	<5 %		< 3.5 %	
at 266 nm	<10 %		< 6 %	
Pulse repetition rate <sup>6)</sup>	100 Hz	50 Hz	30 Hz	100 Hz
Power drift <sup>7)</sup>	<1 %			
Pulse duration <sup>8)</sup>	7–9 ns		5–7 ns	
Linewidth	<1 cm <sup>-1</sup>			
Beam profile	Hat top			
Beam divergence <sup>9)</sup>	<1 mrad	<0.8 mrad	<0.6 mrad	< 0.8 mrad
Beam pointing stability <sup>10)</sup>	< 50 μrad rms			
Polarization	linear, >95 %			
Typical beam diameter <sup>11)</sup>	4 mm		5 mm	
Optical pulse jitter <sup>12)</sup>	<0.5 ns rms			

PHYSICAL CHARACTERISTICS

Laser head (W × L × H)	190 × 305 × 165 mm
Power supply unit (W × L × H)	365 × 392 × 289 mm
Umbilical length	2.5 m

OPERATING REQUIREMENTS

Cooling <sup>13)</sup>	air cooled
Ambient temperature	18–27 °C
Relative humidity	20–80 % (non-condensing)
Power requirements	100–240 V AC, single phase, 50/60 Hz
Power consumption <sup>14)</sup>	<1 kVA

<sup>1)</sup> Due to continuous improvement, all specifications are subject to change without notice. The 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 1064 nm.  
<sup>2)</sup> With H300SH, H300S or H300SHC module. See NL230 series harmonics generator selection guide on the page 63 for more detailed information.  
<sup>3)</sup> With H300STH and H300ST harmonics generator modules. See NL230 series harmonics generator selection guide on the page 63 for more detailed information.  
<sup>4)</sup> With H300SH and H400FHC harmonic generator modules. See NL230 series harmonics generator selection guide on the page 63 for more detailed information.  
<sup>5)</sup> Averaged from 300 pulses.

<sup>6)</sup> Variable 0–50 Hz pulse repetition rate version for NL231 model is available. Please contact EKSPILA for specifications.  
<sup>7)</sup> Measured over 8 hours period when ambient temperature variation is less than ± 2 °C.  
<sup>8)</sup> FWHM measured with photodiode featuring 500 ps rise time and 300 MHz bandwidth oscilloscope.  
<sup>9)</sup> Full angle measured at the 1/e<sup>2</sup> level.  
<sup>10)</sup> RMS value measured from 300 shots.  
<sup>11)</sup> Beam diameter is measured at 1064 nm at the 1/e<sup>2</sup> level.  
<sup>12)</sup> Respect to SYNC OUT pulse.  
<sup>13)</sup> Cooled by build-in chiller.  
<sup>14)</sup> Required current rating can be calculated by dividing power rating value by mains voltage value.



Optional Harmonics generator and attenuators modules

The following are suggested optimal configurations of H300 series modules for various output wavelengths:

1. For **2<sup>nd</sup> harmonics** output only: the H300SHC module.
2. For **2<sup>nd</sup> and 3<sup>rd</sup> harmonics**:
  - a) H300SH+H300S+H300THC – for SH and TH output as specified in the NL230 series brochure.
  - b) H300STH+H300ST – a cost-effective solution not requiring the replacement of modules when changing from a 532 nm to 355 nm beam and vice versa. The 532 nm beam specification will, however, be 15% lower relative to the values in the NL230 series brochure due to extra components in the beam path.
3. For **2<sup>nd</sup> and 4<sup>th</sup> harmonics**: H300SH+H300S+H300FHC modules.
4. For **all harmonics including 4<sup>th</sup>**:
  - a) H300STH+H300ST+H300FHC – a cost-effective solution. The 266 nm and 532 nm beam specifications will be 15% lower relative to the values in the NL230 series brochure.
  - b) H300SH+H300S+H300THC+H300FHC – a slightly more expensive solution with output values adhering to those in the NL230 series brochure.
5. For **attenuators** for all wavelengths up to the 4<sup>th</sup> harmonic: H300SH+H300A2+H300TH+H300A3+H300A4 modules.

Modules Selection Guide

Module	Description	Output ports	Output pulse energy specifications	Dimensions W×L×H, mm	Extension possible?	Notes
H300SH	Second harmonic generator	Port 1: 1064 & 532 nm	N/A	154×160×128	Yes	
H300S	532 nm beam separator	Port 1: 532 nm Port 2: residual 1064 nm	See NL230 specifications for 532 nm beam	154×160×128	No	Should be used with H300SH
H300SHC	Second harmonic generator with 532 nm beam separator	Port 1: 532 nm Port 2: residual 1064 nm	See NL230 specifications for 532 nm beam	154×210×128	No	
H300TH	Third harmonic generator	Port 1: 1064, 532 & 355 nm	N/A	154×160×128	Yes	Should be used with H300SH
H300THC	Third harmonic generator with 355 nm beam separator	Port 1: 355 nm Port 2: residual 1064 & 532 nm	See NL230 specifications for 355 nm beam	154×210×128	No	Should be used with H300SH
H300STH	Second and third harmonics generator	Port 1: 1064, 532 & 355 nm	N/A	154×210×128	Yes	
H300ST	355 nm beam separator	Port 1: 355 nm Port 2: residual 532 nm	See NL230 specifications for 355 nm beam	154×160×128	No	Recommended to use with H300STH
H300FHC	Fourth harmonic generator with 266 nm beam separator	Port 1: 266 nm Port 2: residual 532 nm	See NL230 specifications for 266 nm beam	154×290×128	No	Should be used with H300SH
H300A1	Attenuator for 1064 nm beam	Port 1: 1064 nm beam	Transmission in 5-90% range at 1064 nm	154×210×128	No	
H300A2	Attenuator and beam separator for 532 nm beam	Port 1: 532 nm Port 2: residual 532 nm	Transmission in 5-90% range at 532 nm	154×210×128	No	Should be used with H300SH
H300A3	Attenuator and beam separator for 355 nm beam	Port 1: 355 nm Port 2: residual 355 nm	Transmission in 5-90% range at 355 nm	154×210×128	No	Should be used with H300TH or H300STH
H300A4	Fourth harmonic generator, beam separator and attenuator for 266 nm beam	Port 1: 266 nm Port 2: residual 266 nm	Transmission in 5-90% range at 266 nm	154×350×128	No	Should be used with H300SH

PERFORMANCE

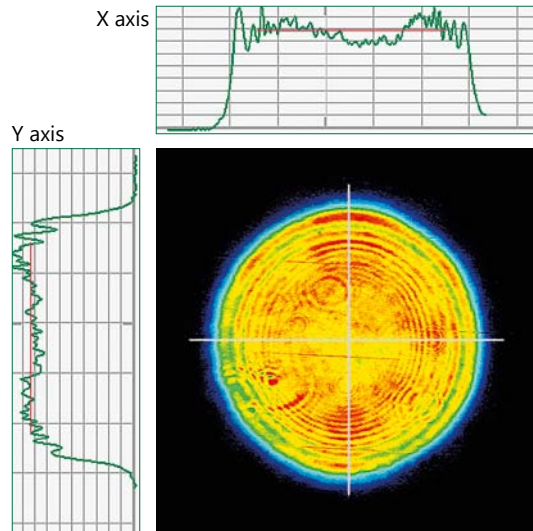


Fig 1. NL230 laser typical near field beam profile

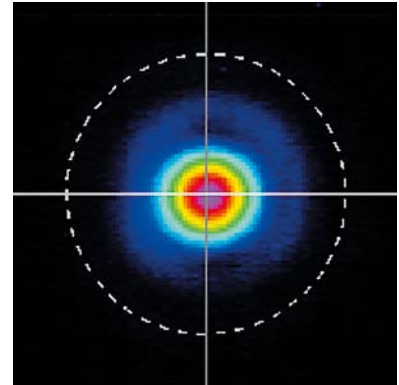
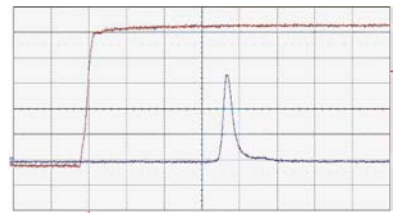


Fig 2. NL230 laser typical far field beam profile

Measure	P1.delay	P2.width	P3.area
value	72.011 ns	5.507 ns	2.358455 mVs
mean	72.044 ns	5.482 ns	2.355738 mVs
min	71.456 ns	5.167 ns	2.277066 mVs
max	72.552 ns	5.970 ns	2.409653 mVs
sdev	156.11 ps	81.27 ps	16.89196 pVs
num	$4.697 \times 10^3$	$4.697 \times 10^3$	$4.697 \times 10^3$



NL230 laser pulse waveform

OUTLINE DRAWINGS

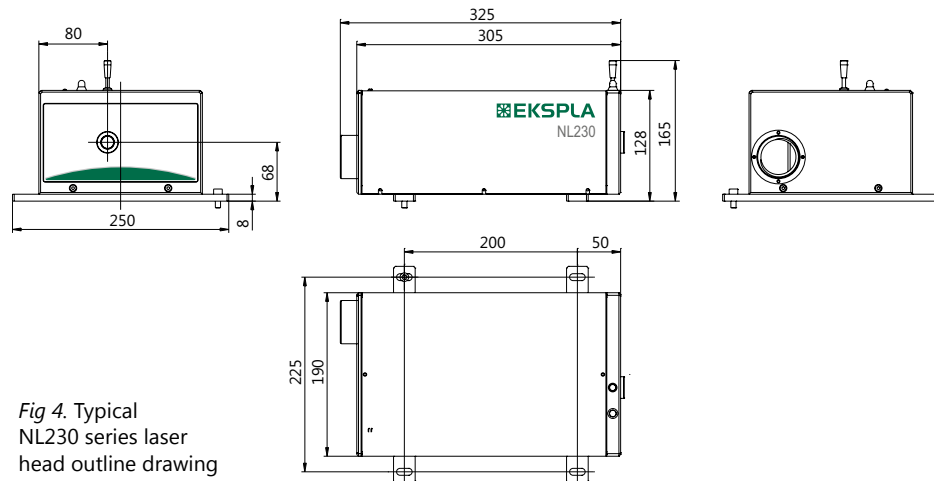


Fig 4. Typical NL230 series laser head outline drawing

ORDERING INFORMATION

NL230-H300SH-H300THC

Model Optional harmonic generator modules and other accessories