

# NL230 SERIES



The NL230 series diode-pumped Q-switched lasers produce up to 150 mJ at 100 Hz or up to 190 mJ at 50 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 3–7 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
- ▶ Rugged sealed laser cavity
- ▶ Up to **190 mJ** at **1064 nm** pulse energy
- ▶ Up to **100 Hz** pulse repetition rate
- ▶ Short pulse duration in the **3–7 ns** range
- ▶ Variable reflectivity output coupler for low-divergence beam
- ▶ Quiet operation: no more flashlamp firing sound
- ▶ Air cooled
- ▶ 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
- ▶ Optional attenuators for fundamental or/and harmonics wavelengths

### 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   | NL230-30   | NL230-100 | NL231-50         | NL231-100 |
|---|--|-----------|------------------|-----------|
| Pulse energy (not less than) <sup>2)</sup>    |  |           |                  |           |
| at 1064 nm                                    | 140 mJ   | 60 mJ     | 190 mJ           | 150 mJ    |
| at 532 nm <sup>3)</sup>                       | 70 mJ  | 30 mJ     | 90 mJ            | 70 mJ     |
| at 355 nm <sup>4)</sup>                       | 40 mJ  | 15 mJ     | 55 mJ            | 40 mJ     |
| at 266 nm <sup>5)</sup>                       | 14 mJ  | 4 mJ      | 16 mJ            | 13 mJ     |
| Pulse energy stability (StdDev) <sup>6)</sup> |  |           |                  |           |
| at 1064 nm                                    | <1 %   |           |                  |           |
| at 532 nm                                     | <2.5 %   |           |                  |           |
| at 355 nm                                     | <3.5 %   |           |                  |           |
| at 266 nm                                     | <6 %   |           |                  |           |
| Pulse repetition rate                         | 30 Hz  | 100 Hz    | 50 Hz            | 100 Hz    |
| Power drift <sup>7)</sup>                     | <2 %   |           |                  |           |
| Pulse duration <sup>8)</sup>                  | 3 – 7 ns   |           |                  |           |
| Linewidth                                     | <1 cm <sup>-1</sup> at 1064 nm                             |           |                  |           |
| Beam profile <sup>9)</sup>                    | "Top Hat" in near field and close to Gaussian in far field |           |                  |           |
| Beam divergence <sup>10)</sup>                | <0.8 mrad  |           |                  |           |
| Beam pointing stability <sup>11)</sup>        | ≤60 μrad rms   |           |                  |           |
| Polarization                                  | linear, >95 % at 1064 nm                                   |           |                  |           |
| Typical beam diameter <sup>12)</sup>          | 5 mm   |           |                  |           |
| Optical pulse jitter                          |  |           |                  |           |
| Internal triggering regime <sup>13)</sup>     | <0.5 ns rms  |           |                  |           |
| External triggering regime <sup>14)</sup>     | <0.5 ns rms  |           |                  |           |
| SYNC OUT pulse delay                          | -100 μs ... 100 ms   |           |                  |           |
| Typical warm-up time                          | 5 min  |           |                  |           |
| <b>PHYSICAL CHARACTERISTICS</b>               |  |           |                  |           |
| Laser head size (W × L × H)                   | 190×305×165 mm ±3 mm                                       |           |                  |           |
| Power supply unit (W × L × H)                 |  |           |                  |           |
| Desktop case                                  | 471×391×147 mm ±3 mm                                       |           |                  |           |
| 19" module                                    | 483×355×133 mm ±3 mm                                       |           |                  |           |
| External chiller (where applicable)           | inquire  |           |                  |           |
| Umbilical length                              | 2.5 m  |           |                  |           |
| <b>OPERATING REQUIREMENTS</b>                 |  |           |                  |           |
| Cooling (air cooled) <sup>15)</sup>           | built in chiller   |           | external chiller |           |
| Ambient temperature                           | 18–27 °C   |           |                  |           |
| Relative humidity (non-condensing)            | 20–80 %  |           |                  |           |
| Power requirements                            | 100–240 V AC, single phase, 50/60 Hz                       |           |                  |           |
| Power consumption                             | <1.0 kVA   |           |                  |           |

<sup>1)</sup> Due to continuous improvement, all specifications are subject to change without notice. The parameters marked typical may vary with each unit we manufacture. Unless stated otherwise all specifications are measured at 1064 nm.  
<sup>2)</sup> Outputs are not simultaneous.  
<sup>3)</sup> With H300SH and H300S or H300SHC harmonics generator module. See harmonics generator selection guide for more detailed information.  
<sup>4)</sup> With H300STH and H300ST harmonics or H300SH and H300THC generator modules. See harmonics generator selection guide for more detailed information.  
<sup>5)</sup> With H300SH and H400FHC harmonic generator modules. See harmonics generator selection guide for more detailed information.  
<sup>6)</sup> Averaged from pulses, emitted during 30 sec time interval.

<sup>7)</sup> Measured over 8 hours period after 20 min warm-up when ambient temperature variation is less than ± 2 °C.  
<sup>8)</sup> FWHM.  
<sup>9)</sup> Near field (at the output aperture) TOP HAT fit is >80%.  
<sup>10)</sup> Full angle measured at the 1/e<sup>2</sup> level.  
<sup>11)</sup> Beam pointing stability is evaluated as movement of the beam centroid in the focal plane of a focusing element.  
<sup>12)</sup> Average of X- and Y-plane full angle divergence values measured at the 1/e<sup>2</sup> level at 1064 nm.  
<sup>13)</sup> With respect to SYNC OUT pulse.  
<sup>14)</sup> With respect to QSW IN pulse.  
<sup>15)</sup> Adequate room air conditioning should be provided.



**Notes:** The laser and auxiliary units must be settled in such a place void of dust and aerosols. It is advisable to operate the laser in air conditioned room, provided that the laser is placed at a distance from air conditioning outlets. The laser should be positioned on a solid worktable. Access from one side should be ensured. Intensive sources of vibration should be avoided near the laboratory (ex. railway station or similar).

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.
  - 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 specified above 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 specified above.
  - b) H300SH+H300S+H300THC+H300FHC – a slightly more expensive solution with output values adhering to specified above.
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/D                                      | 154×160×128          | Yes                 |                                       |
| H300S    | 532 nm beam separator  | Port 1: 532 nm<br>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<br>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<br>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<br>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<br>Port 2: residual 532 nm             | See NL230 specifications for 266 nm beam | 154×290×128          | No                  | Should be used with H300SH            |
| H300FiHC | Fifth harmonics generator with 213 nm beam separator                     | Port 1: 213 nm<br>Port 2: residual 1064, 532 & 266 nm | See NL230 specifications for 213 nm beam | 154×300×128          | No                  |                                       |
| 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<br>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<br>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<br>Port 2: residual 266 nm             | Transmission in 5-90% range at 266 nm    | 154×350×128          | No                  | Should be used with H300SH            |

PERFORMANCE

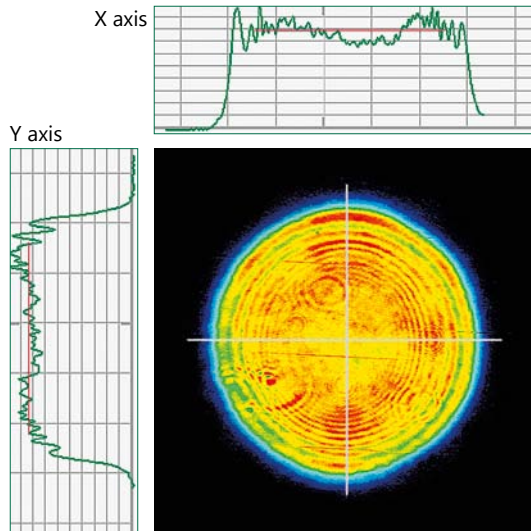


Fig 1. NL230 laser typical near field beam profile

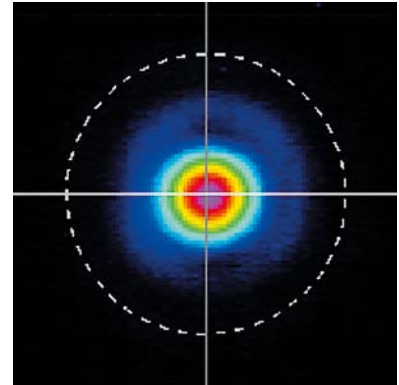
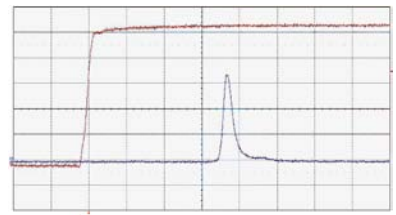


Fig 2. NL230 laser typical far field beam profile

| 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

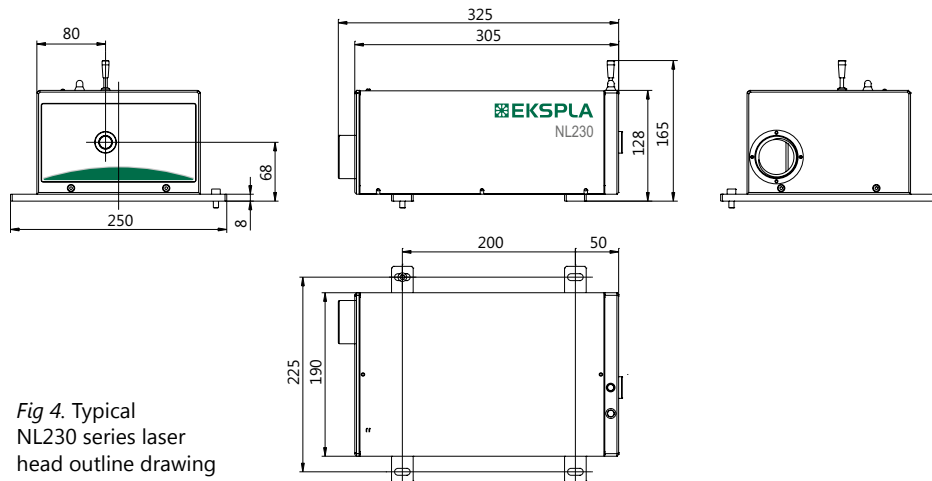


Fig 4. Typical NL230 series laser head outline drawing

ORDERING INFORMATION

NL230-H300SH-H300THC

Model Optional harmonic generator modules and other accessories