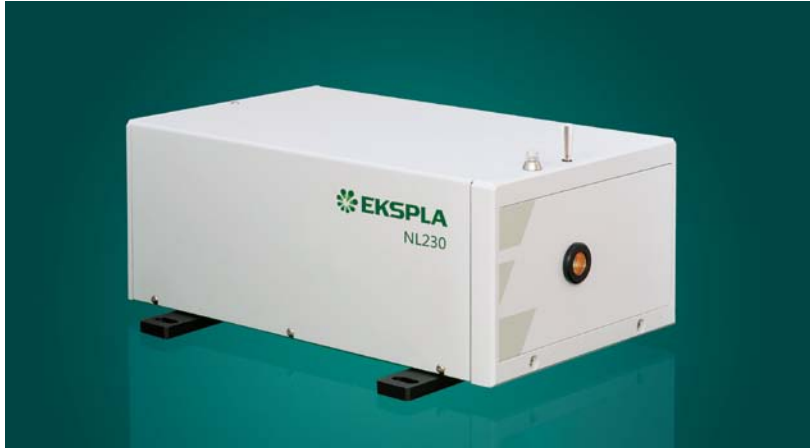


NL230 SERIES



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 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
- ▶ Photo acoustic imaging

SPECIFICATIONS ¹⁾

Model	NL231-50	NL231-100
Pulse energy (not less than) ²⁾		
at 1064 nm	190 mJ	150 mJ
at 532 nm ³⁾	90 mJ	70 mJ
at 355 nm ⁴⁾	55 mJ	40 mJ
Pulse energy stability (StdDev) ⁵⁾		
at 1064 nm	<1 %	
at 532 nm	<2.5 %	
at 355 nm	<3.5 %	
Pulse repetition rate	50 Hz	100 Hz
Power drift ⁶⁾	< ±1 %	
Pulse duration ⁷⁾	3 – 7 ns	
Linewidth	<1 cm ⁻¹ at 1064 nm	
Beam profile ⁸⁾	"Top Hat" in near field and close to Gaussian in far field	
Beam divergence ⁹⁾	<0.8 mrad	
Beam pointing stability ¹⁰⁾	≤60 µrad rms	
Polarization	linear, >95 % at 1064 nm	
Typical beam diameter ¹¹⁾	5 mm	
Optical pulse jitter		
Internal triggering regime ¹²⁾	<0.5 ns rms	
External triggering regime ¹³⁾	<0.5 ns rms	
SYNC OUT pulse delay	-100 µs ... 100 ms	
Typical warm-up time	5 min	
PHYSICAL CHARACTERISTICS		
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	
OPERATING REQUIREMENTS		
Cooling (air cooled) ¹⁴⁾	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	

¹⁾ 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.
²⁾ Outputs are not simultaneous. Inquire for fourth 266 nm and fifth 213 nm harmonic specifications.
³⁾ With H200SH and H200S or H200SHC harmonics generator module. See harmonics generator selection guide for more detailed information.
⁴⁾ With H200STH and H200ST harmonics or H200SH and H200THC generator modules. See harmonics generator selection guide for more detailed information.
⁵⁾ Averaged from pulses, emitted during 30 sec time interval.

⁶⁾ Measured over 8 hours period after 20 min warm-up when ambient temperature variation is less than ± 2 °C.
⁷⁾ FWHM.
⁸⁾ Near field (at the output aperture) TOP HAT fit is >80%.
⁹⁾ Full angle measured at the 1/e² level.
¹⁰⁾ Beam pointing stability is evaluated as movement of the beam centroid in the focal plane of a focusing element.
¹¹⁾ Beam diameter is measured at 1064 nm at the 1/e² level.
¹²⁾ With respect to SYNC OUT pulse.
¹³⁾ With respect to QSW IN pulse.
¹⁴⁾ 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).

CONFIGURATIONS

The following are suggested optimal configurations of H200 series modules for various output wavelengths:

1. For **2nd harmonics** output only: the H200SHC module.
2. For **2nd and 3rd harmonics**:
 - a) H200SH+H200S+H200THC – for SH and TH output.
 - b) H200STH+H200ST – 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 **attenuators** for all wavelengths up to the 3th harmonic: H200A1+H200SH+H200A2+H200TH+H200A3 modules.

Modules Selection Guide

Module	Description	Output ports	Output pulse energy specifications	Dimensions W×L×H, mm	Extension possible?	Notes
H200SH	Second harmonic generator	Port 1: 1064, 532 nm	N/d	154×160×128	Yes	
H200S	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 H200SH
H200SHC	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	
H200TH	Third harmonic generator	Port 1: 1064, 532 & 355 nm	N/a	154×160×128	Yes	Should be used with H200SH
H200THC	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 H200SH
H200STH	Second and third harmonics generator	Port 1: 1064, 532 & 355 nm	N/a	154×210×128	Yes	
H200ST	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 H200STH
H200A1	Attenuator for 1064 nm beam	Port 1: 1064 nm beam	Transmission in 5–90% range at 1064 nm	154×210×128	No	
H200A2	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 H200SH
H200A3	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 H200TH or H200STH

PERFORMANCE

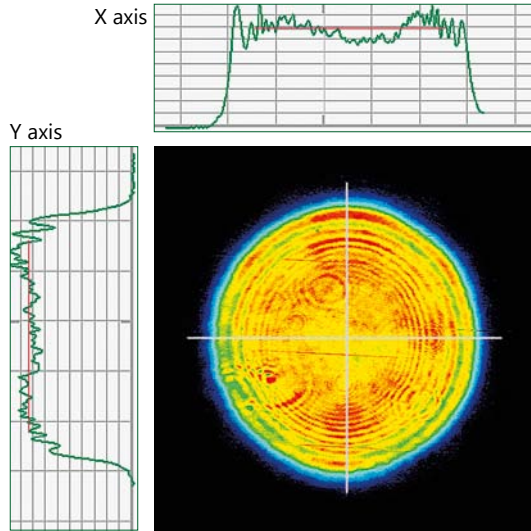


Fig 1. NL230 laser typical near field beam profile

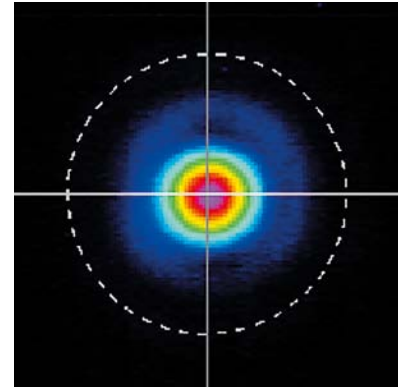
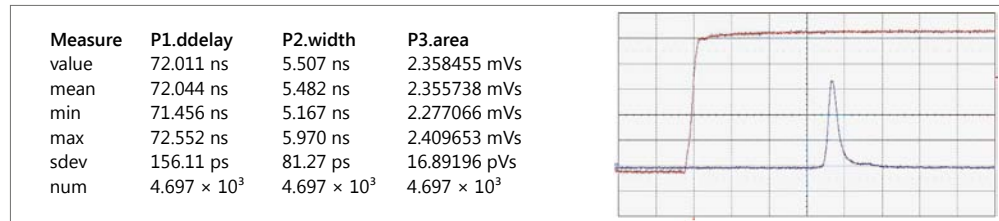


Fig 2. NL230 laser typical far field beam profile



NL230 laser pulse waveform

OUTLINE DRAWINGS

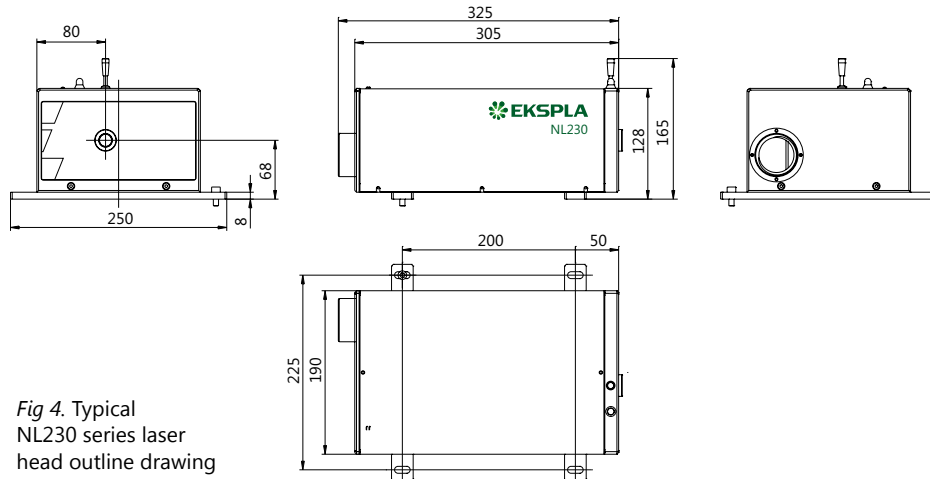


Fig 4. Typical NL230 series laser head outline drawing

ORDERING INFORMATION

NL230-H200SH-H200THC

Model Optional harmonic generator modules and other accessories

HARMONIC GENERATORS

For NL230 Series Lasers

Nanosecond Q-switched lasers enable simple and cost effective laser wavelength conversion to shorter wavelengths through harmonics generation. EKSPLA offers a broad selection of wavelength conversion accessories for NL230 series lasers.

The harmonics module uses a modular design that allows reconfiguration of laser output for the appropriate experiment wavelength.

A typical module houses a non-linear crystal together with a set of dichroic mirrors for separating the harmonic beam from the fundamental wavelength. Nonlinear crystals used for the purpose of wavelength

conversion are kept at an elevated temperature in a thermo-stabilized oven.

Two or more modules can be joined together for higher harmonics generation: attaching one extra module to a second harmonic generator allows for the generation of 3rd wavelengths.

It should be noted that only modules with a single output port can be joined together: it is possible to attach a H200S module to a H200SH unit for 532 nm beam separation. Modules with two output ports (e.g., H200SHC) cannot be attached to extra units.

FEATURES

- ▶ Compact harmonic modules
- ▶ Thermo stabilized crystals for long lifetime
- ▶ Dichroic mirrors
- ▶ AR coatings on crystals
- ▶ Phase matching by mechanical adjustment
- ▶ High conversion efficiency
- ▶ Wide selection of different

H200SH 2nd harmonic generator

SPECIFICATIONS

Output ports	
Port #1	1064 & 532 nm
Typical conversion efficiency ¹⁾	50 – 60% (depending on laser model)
Output pulse energy	N/A
Dimensions (W×H×L)	154×128×160 mm
Extension possibility	Yes

¹⁾ 1064 nm wavelength beam conversion efficiency.

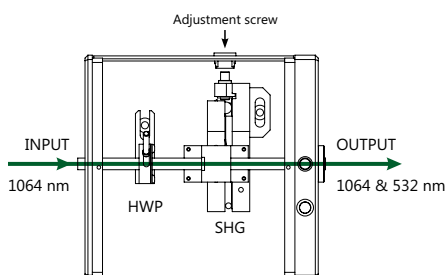


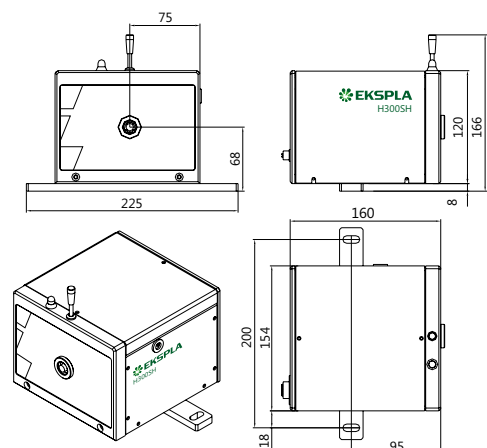
Fig.1. Optical layout of the H200SH.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ Contains SH crystal with half-wave plate for input polarization adjustment
- ▶ 532 nm and 1064 nm outputs
- ▶ SH crystal thermo stabilized for long lifetime

Fig. 2. Dimensions and output port position of H200SH module.



H200S separators module

SPECIFICATIONS

Output ports	
Port #1	532 nm
Port #2	residual 1064 nm
Output pulse energy	See NL230 specifications for 532 nm beam
Dimensions (W×H×L)	154×128×160 mm
Extension possibility	No

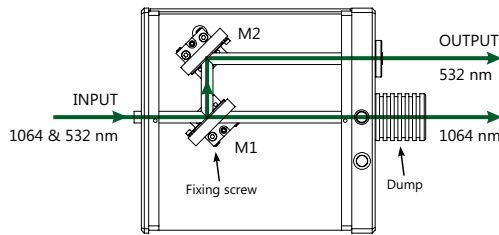


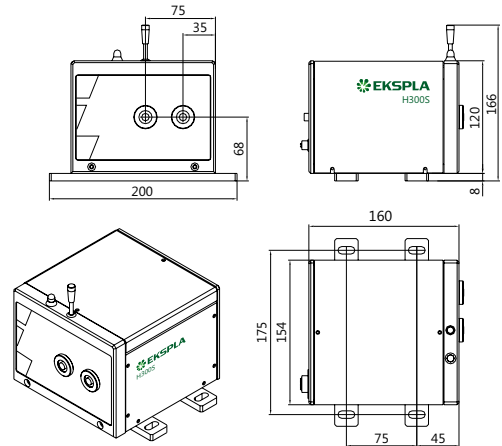
Fig.1. Optical layout of the H200S.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ 532 nm and 1064 nm outputs

Fig. 2. Dimensions and output port position of H200S module.



H200SHC 2nd harmonic generator with separator

SPECIFICATIONS

Output ports	
Port #1	532 nm
Port #2	residual 1064 nm
Typical conversion efficiency ¹⁾	50 – 60% (depending on laser model)
Output pulse energy	See NL230 specifications for 532 nm beam
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

¹⁾ 1064 nm wavelength beam conversion efficiency.

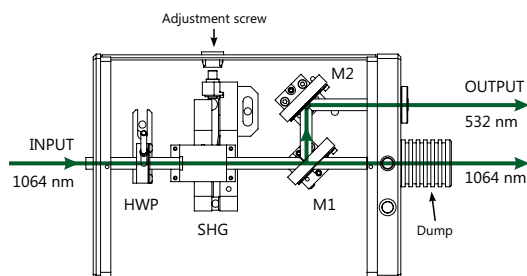


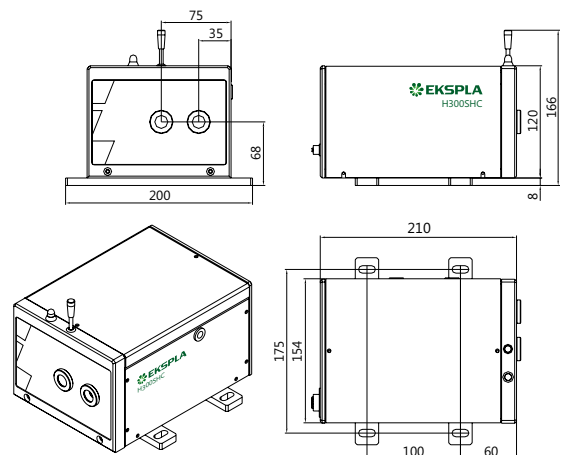
Fig.1. Optical layout of the H200SHC.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ Contains SH crystal with half-wave plate for input polarization adjustment
- ▶ 532 nm and 1064 nm outputs
- ▶ SH crystal thermo stabilized for long lifetime

Fig. 2. Dimensions and output port position of H200SHC module.



H200TH 3rd harmonic generator

SPECIFICATIONS

Output ports	
Port #1	1064, 532 & 355 nm
Typical conversion efficiency ¹⁾	20 – 30% (depending on laser model)
Output pulse energy ²⁾	N/A
Dimensions (W×H×L)	154×128×160 mm
Extension possibility	Yes

¹⁾ 1064 nm wavelength beam conversion efficiency.
²⁾ When used with H200SH.

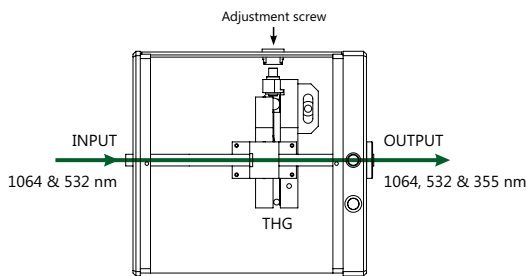


Fig. 1. Optical layout of the H200TH.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ Contains TH crystal with half-wave plate for input polarization adjustment
- ▶ **355 nm, 532 nm and 1064 nm** outputs
- ▶ TH crystal thermo stabilized for long lifetime

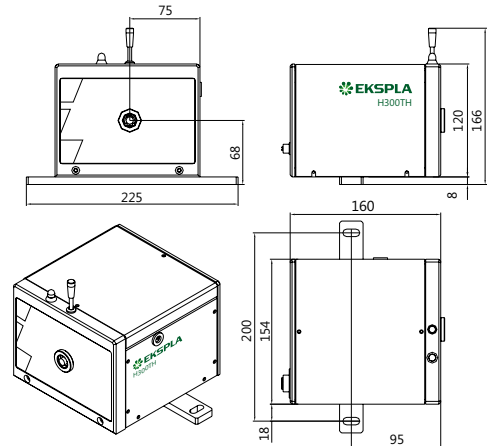


Fig. 2. Dimensions and output port position of H200TH module.

H200ST 2nd and 3rd harmonic separator

SPECIFICATIONS

Output ports	
Port #1	355 nm
Port #2	residual 532 nm
Output pulse energy ¹⁾	See NL230 specifications for 355 nm beam
Dimensions (W×H×L)	154×128×160 mm
Extension possibility	No

¹⁾ When used with H200STH.

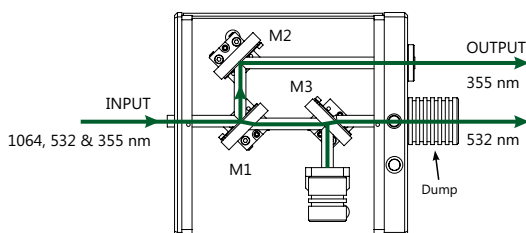


Fig. 1. Optical layout of the H200ST.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ **355 nm and 532 nm** outputs
- ▶ High damage threshold dielectric mirrors

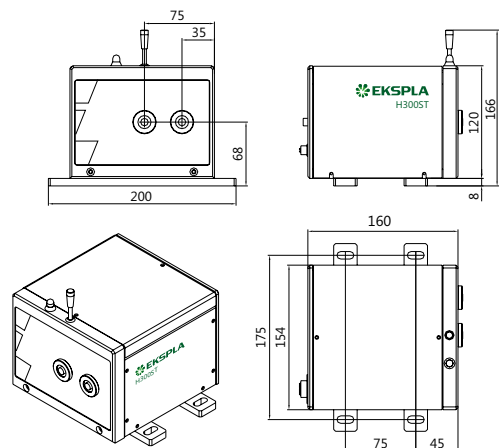


Fig. 2. Dimensions and output port position of H200ST module.

H200THC 3rd harmonic generator with separator

SPECIFICATIONS

Output ports	
Port #1	355 nm
Port #2	residual 1064 & 532 nm
Typical conversion efficiency ¹⁾	20 – 30 % (depending on laser model)
Output pulse energy ²⁾	See NL230 specifications for 355 nm beam
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

¹⁾ From 1064 nm wavelength to respective harmonic wavelength.
²⁾ When used with H200SH.

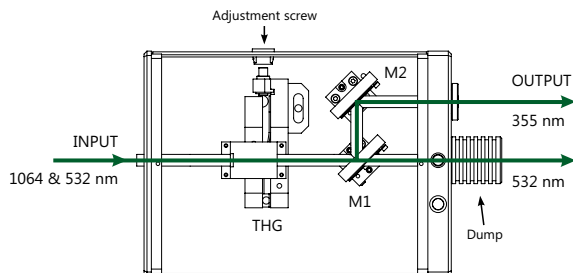


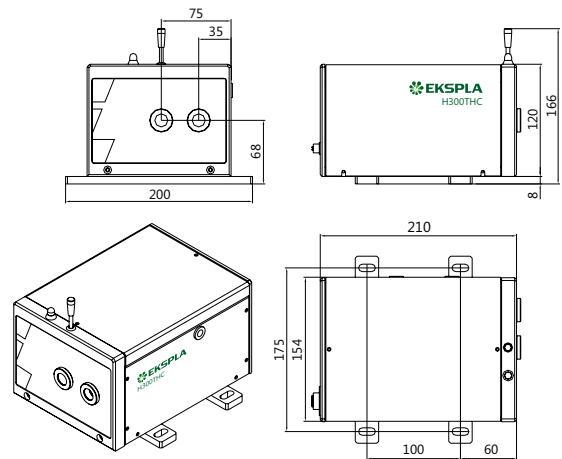
Fig. 1. Optical layout of the H200THC.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ Contains TH crystal with half-wave plate for input polarization adjustment
- ▶ 355 nm and 532 nm outputs
- ▶ TH crystal thermo stabilized for long lifetime

Fig. 2. Dimensions and output port position of H200THC module.



H200STH 2nd and 3rd harmonic generator without separator

SPECIFICATIONS

Output ports	
Port #1	355 nm and residual 1064 & 532 nm
Typical conversion efficiency ¹⁾	20 – 30 % (depending on laser model)
Output pulse energy	N/A
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

¹⁾ From 1064 nm wavelength to respective harmonic wavelength.

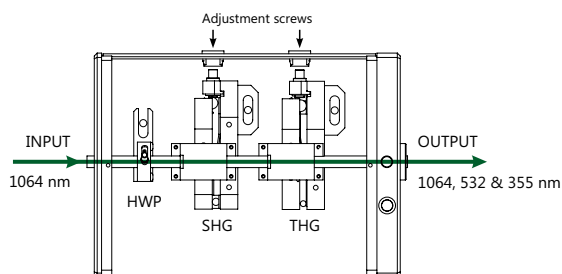


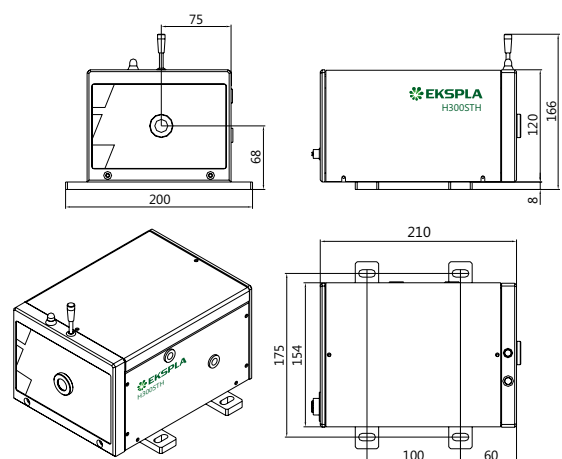
Fig. 1. Optical layout of the H200STH.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for demonstration of layout.

FEATURES

- ▶ Contains SH and TH crystals with half-wave plate for input polarization adjustment
- ▶ 355 nm, 532 nm and 1064 nm outputs
- ▶ SH and TH crystals thermo stabilized for long lifetime

Fig. 2. Dimensions and output port position of H200STH module.



ATTENUATORS

For NL230 Series Lasers

NL230 series lasers offer several options for changing output pulse energy. The easiest option is to change the timing of the Q-switch opening relative to the flashlamp pump pulse. This option is a standard feature for all NL230 series lasers. A change in Q-switch timing, however, changes other laser pulse parameters along with the pulse energy.

A decrease in pulse energy results in longer pulse duration, decreased pulse-to-pulse-stability, and possible changes in the spatial beam profile. For applications that require smooth adjustment of output pulse energy while keeping other parameters stable, EKSPLA offers H200Ax series attenuator modules.

FEATURES

- ▶ Compact design
- ▶ Motorized
- ▶ Smooth adjustment of output pulse energy

H200A1 attenuator at 1064 nm

SPECIFICATIONS

Output ports	
Port #1	1064 nm
Output pulse energy	transmission in 5 – 90 % range at 1064 nm
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

FEATURES

- ▶ Smooth adjustment of output pulse energy without change of other pulse parameters
- ▶ Motorized

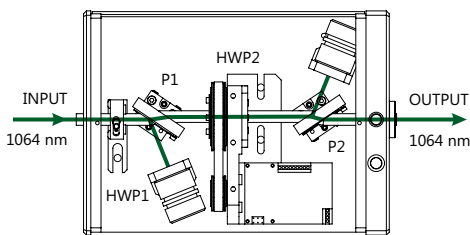
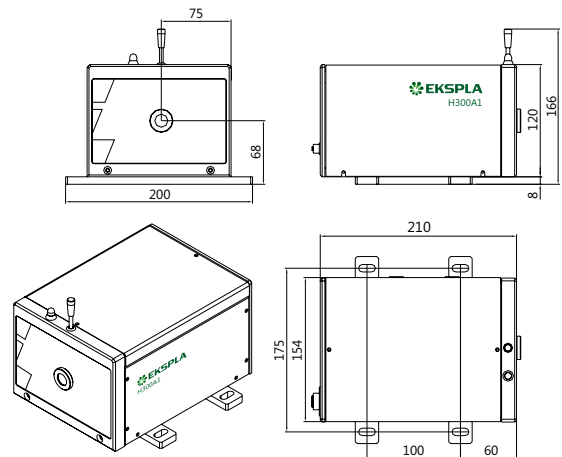


Fig.1. Optical layout of the H200A1.

Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for easier understanding. Half wave plate (HWP2) is adjusted automatically.

Fig. 2. Dimensions and output port position of H200A1 module.



H200A2 attenuator at 532 nm

SPECIFICATIONS

Output ports	
Port #1	532 nm
Port #2	residual 532 nm
Output pulse energy ¹⁾	transmission in 5 – 90 % range at 532 nm
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

¹⁾ When used with H200SH.

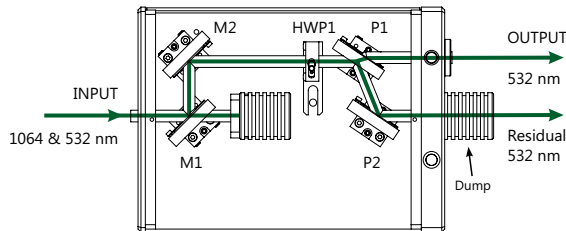
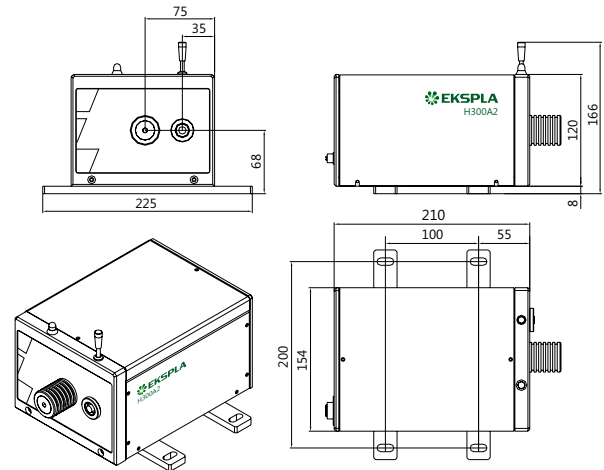


Fig.1. Optical layout of the H200A2.
Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for easier understanding. Half wave plate (HWP1) is adjusted automatically.

Fig. 2. Dimensions and output port position of H200A2 module.



FEATURES

- ▶ Smooth adjustment of output pulse energy without change of other pulse parameters
- ▶ Motorized

H200A3 attenuator at 355 nm

SPECIFICATIONS

Output ports	
Port #1	355 nm
Port #2	residual 355 nm
Output pulse energy ¹⁾	transmission in 5 – 90 % range at 355 nm
Dimensions (W×H×L)	154×128×210 mm
Extension possibility	No

¹⁾ When used with H200TH or H200STH.

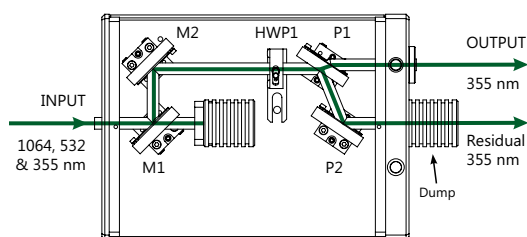
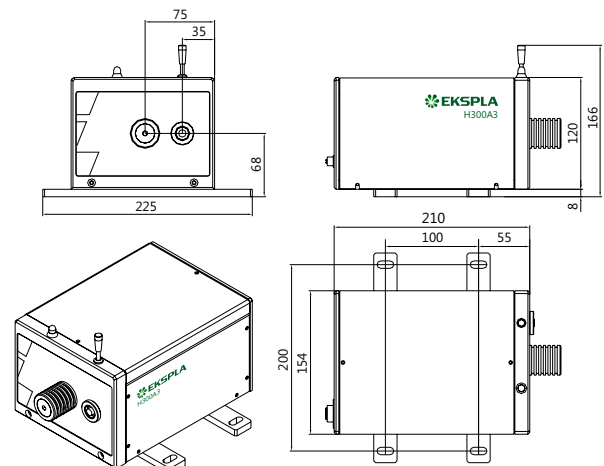


Fig.1. Optical layout of the H200A3.
Note: The optical layout drawing does not reflect the actual positions or number of optical components – it is simplified for easier understanding. Half wave plate (HWP1) is adjusted automatically.

Fig. 2. Dimensions and output port position of H200A3 module.



FEATURES

- ▶ Smooth adjustment of output pulse energy without change of other pulse parameters
- ▶ Motorized