

# H1 series

## STAND-ALONE HARMONICS GENERATOR

### FEATURES

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Stand-alone 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> or 5<sup>th</sup> harmonic generator compatible with Q1 series lasers

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Factory-configurable **two exit ports**

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Microprocessor controlled temperature tuned nonlinear crystals

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Remote monitoring and control via common with laser or separate **Ethernet** interface

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Optional attachable attenuator

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Optional attachable pulse energy monitor

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Optional fiber coupled output

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H1 is stand-alone harmonic generator module is designed to be used with our Q1 series lasers. Module is intended to be mounted side-by-side with Q1 laser on common optical table or breadboard.

H1 has two exit ports that can be factory-configured to emit up to 5<sup>th</sup> harmonic wavelengths. Most common standard configurations are listed in the table below.

Harmonic generation is a phase-sensitive process which requires phase matching to be efficient. Phase matching is possible in birefringent crystals, by finely tuning refractive indexes of interacting laser beams to required values. There are two ways to change refractive index of birefringent crystal: by changing its temperature or by changing incidence angle of laser beam.

In H1 modules phase matching of crystals is optimized by changing crystal temperature. Build-in microprocessor is used to fine tune and keep temperature stable. When supplied together with Q1 series laser, status of H1 can be remotely monitored and controlled from laser control panel (PC is required). Alternatively, control is possible directly via build-in Ethernet interface.

Most of high performance birefringent crystals are hygroscopic, which might limit their lifetime in humid environment. However, if they are continuously kept at higher than ambient temperatures, the lifetime of crystals can be significantly extended and can be even longer than laser system itself. To keep crystals dry, H1 module needs to be always connected to the power source. If power is not available, the module should be stored in dry environment.

Module functionality can be further extended by auxiliary equipment:

- › Pulse energy of harmonic wavelength can be adjusted with our motorized attenuator. Models for up to 5<sup>th</sup> harmonic are available.
- › Pulse energy can be monitored by our attachable pulse energy monitor that can be attached directly to the harmonic generator or attenuator.
- › Fiber coupled output is available by request. Please inquire for detailed specifications.

### AUXILIARY EQUIPMENT

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Attachable motorized attenuator for up to 5<sup>th</sup> harmonic beam

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Attachable pulse energy monitor with analog and/or digital output

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Fiber coupled output

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## SPECIFICATIONS <sup>1)</sup>

MODEL	H1
Conversion efficiency <sup>2)</sup>	
Fundamental to second harmonic	> 50 %
Fundamental to third harmonic	> 30 %
Fundamental to fourth harmonic	> 15 %
Fundamental to fifth harmonic	> 6 %
Pulse to pulse energy stability <sup>3)</sup>	
526.5 / 532 nm	<2.5 % RMS
351 / 355 nm	<3.5 % RMS
263 / 266 nm	<4 % RMS
211 / 213 nm	<5 % RMS
Spectral purity for Port #1 <sup>4)</sup>	>99%
Typical pulse duration	10 – 20% shorter in each conversion stage
Typical beam diameter	10 – 30 % smaller than pump beam
Beam pointing stability	same as of pump beam
<b>DIMENSIONS</b>	
Harmonic generator (W×L×H)	110 × 242 × 112 mm <sup>3</sup>
<b>OPERATING REQUIREMENTS</b>	
Ambient temperature	15 – 30 °C
Relative humidity	10 – 80 % (non-condensing)
Powering	12 VDC <sup>5)</sup>
Average power consumption	<10 W

<sup>1)</sup> Due to continuous improvements all specifications are subject to change. The parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture.

<sup>2)</sup> Conversion efficiency presented here is for Port #1. Conversion efficiency at Port #2 depends on unit configuration and typically are lower than presented here. Please inquire for details.

<sup>3)</sup> When unit is pumped by our Q1 series laser. Measured during 30 seconds operation after warm-up.

<sup>4)</sup> Spectral purity at Port #2 could not be specified for two-wavelength output configuration.

<sup>5)</sup> When supplied with Q1 laser, H1 is powered from laser controller.

<sup>6)</sup> See drawing below for port number assignment. Inquire for custom configurations.

<sup>7)</sup> Wavelength is shown for 1064 nm pump wavelength. For 1053 nm pump wavelength recalculate wavelengths accordingly.

<sup>8)</sup> Shows compatible attenuator model. This option is available only when H1 is supplied together with Q1 series laser.

<sup>9)</sup> Shows compatible pulse energy monitor model. This option is available only when H1 is supplied together with Q1 series laser.

<sup>10)</sup> Spectral purity is >98 %.

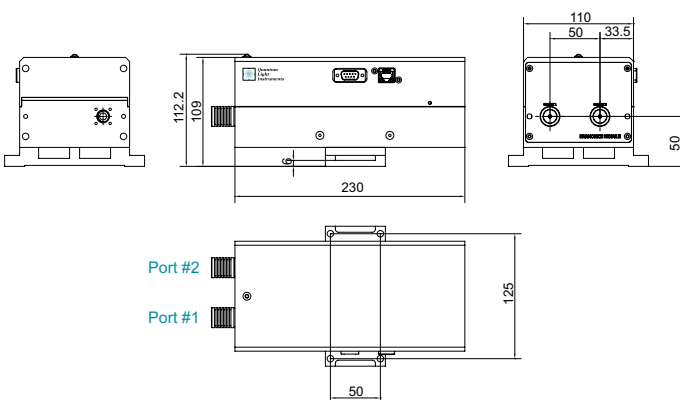
<sup>11)</sup> Both wavelengths exit Port #2, for separation external dichroic mirror is required.

<sup>12)</sup> Spectral purity for this model is >99.9%.

## CONFIGURATION OPTIONS <sup>6)</sup>

H1-	Port #1			Port #2
	Wavelength <sup>7)</sup>	Attenuator (optional) <sup>8)</sup>	Energy monitor (optional) <sup>9)</sup>	Wavelength
SH	532 nm	-AT2	-EM2	1064 nm <sup>10)</sup>
TH	355 nm	-AT3	-EM3	532+1064 nm <sup>11)</sup>
TH/SH	355 nm	-AT3	-EM3	532 nm <sup>10)</sup>
FH	266 nm	-AT4	-EM4	532+1064 nm <sup>11)</sup>
FH/PB	266 nm <sup>12)</sup>	-AT4	-EM4	N/A
FH/SH	266 nm <sup>12)</sup>	-AT4	-EM4	532 nm
FiH	213 nm <sup>12)</sup>	-AT5	-EM5	N/A
FiH/SH	213 nm <sup>12)</sup>	-AT5	-EM5	532 nm

## DRAWINGS



Harmonic generator module H1 dimensions (in mm) & port numbering



Laser head Q1 with attached harmonic generator module H1

