

# Koheras HARMONIK

High-power frequency-doubled laser system



## SINGLE FREQUENCY, LOW NOISE

**Ideal for cutting-edge quantum physics projects**

The HARMONIK system is a high-power frequency-doubled laser system consisting of our popular low-noise Koheras fiber laser platform, BOOSTIK, in combination with our new frequency converter module, HARMONIK.

This maintenance-free laser system provides a superior low-noise single-frequency signal with a unique combination of narrow linewidth, excellent beam quality, and high output power.

### Applications

- Quantum sensing
- Laser cooling and trapping
- Optical clocks
- Cold atom research
- OPO pumping
- High precision spectroscopy

# KOHERAS HARMONIK

The HARMONIK system is a high-power frequency doubled laser system consisting of our popular low-noise Koheras fiber laser platform, BOOSTIK, in combination with our new frequency converter module, HARMONIK.

Depending on your need, choose from two HARMONIK systems, the C7 or the E7.

## Low relative intensity noise

The **C7** has an exceptionally low relative intensity noise: A RIN level of -140 dBc/Hz at 10 MHz.

## Narrow linewidth and low phase noise

The **E7** has a narrow linewidth and very low phase noise: A linewidth of <0.2 kHz and a phase noise of -87 dB(rad/√Hz/m) at 10 Hz.

## High standard output power

For both systems, the standard output power goes up to 7 W. If a higher output power is needed, please contact us about custom power levels.

## Excellent beam quality

The excellent beam quality,  $M^2 < 1.1$ , is suitable for cutting edge quantum physics projects such as quantum sensing and laser cooling and trapping, to mention a few.

## Free-space or fiber output

As default, the HARMONIK systems come with free-space output. If fiber coupling is needed, we can propose an efficient coupling via our unique polarization-maintaining single mode photonic crystal fiber that ensures high-power delivery.

## Rack system and table top

The BOOSTIK system is delivered in a turn-key 19" rack system and the HARMONIK is a table top module.

Model	C7	E7
Supported wavelengths	775-780 nm	775-780 nm
Output power <sup>1)</sup>	Up to 7 W	Up to 7 W
PM fiber delivery	Optional	Optional
RIN	Ultra-low	Low
Linewidth	<30 kHz	<0.2 kHz
Fast modulation	Yes	Yes

<sup>1)</sup> Higher powers are available upon request.

# FEATURES

## Ultra-low noise

The HARMONIK systems offer an ultra-low phase noise as well as low RIN. The RIN is preserved from the pump laser while the linewidth is doubled.

## Fast wavelength modulation

The systems are equipped with easy and user-friendly fast wavelength modulation. This feature is typically used to lock the laser to an external stable reference — such as an atomic transition line or interferometer — to obtain an even higher wavelength stability than provided by the free-running laser.

The HARMONIK systems offer a 15 GHz mode hop-free tunability with a 10% power change.

## Thermal tuning

All Koheras fiber lasers are equipped with thermoelectric temperature controllers (TECs).

The TECs stabilize the operation of the laser and makes it insensitive to environmental temperature fluctuations. The TECs also make it possible to tune the center wavelength by changing the operating temperature of the laser.

At standard room temperature (around 20-30°C or 68-86°F) the laser can be thermally tuned to an industry-leading 1000 pm.

## Features

- Up to 7 W at 780 nm
- Sub-kHz linewidth
- Ultra-low frequency and intensity noise
- Wide wavelength tunability
- Excellent beam quality,  $M^2 > 1.1$
- Temperature stabilized
- Optional PM fiber delivery
- Plug and Play
- Simple user operation
- Robust and maintenance-free

# SPECIFICATIONS

## Optical

Model	C7	E7
Supported wavelength range <sup>1)</sup> [nm]	775 - 780	775 - 780
Laser emission	CW - inherently single frequency	CW - inherently single frequency
Beam quality	$M^2 < 1.1$	$M^2 < 1.1$
Output power [W] <sup>2)</sup>	Up to 7	Up to 7
Linewidth [kHz]	< 30	< 0.2
Max. phase noise [dB(rad/√Hz/m)]	-66 @ 10 Hz -86 @ 100 Hz -106 @ 20 kHz	-87 @ 10 Hz -107 @ 100 Hz -127 @ 20 kHz
RIN peak [MHz]	Approximately 1.0	Approximately 0.7
RIN level [dBc/Hz] <sup>3)</sup>	< -117 @ peak < -137 @ 10 MHz	< -97 @ peak < -132 @ 10 MHz
Long term stability (RMS, 1h @ 25°C) [%] <sup>4)</sup>	< ± 2	< ± 2
Optical S/N (50 pm res.) [dB]	> 50	> 50
Polarization / PER [dB]	Linear > 20	Linear > 20
Degree of polarization / DOP [dB]	≥ 30	≥ 30
Min. thermal wavelength tuning range [pm]	± 175	± 175
Total thermal wavelength tuning range [pm]	500	500
Fast wavelength modulation range [GHz]	16	16
Fast wavelength modulation [kHz]	Up to 20	Up to 20
Typical beam diameter @ 1/e <sup>2</sup> [mm]	2	2

1) Center wavelength is selectable within the specified range. Please ask for options outside the range.

2) Output power depends on the center wavelength.

3) Shot noise-limited > 5 Mhz.

4) After a 10-20 minute warm-up.

# SPECIFICATIONS

## Mechanical/Electrical

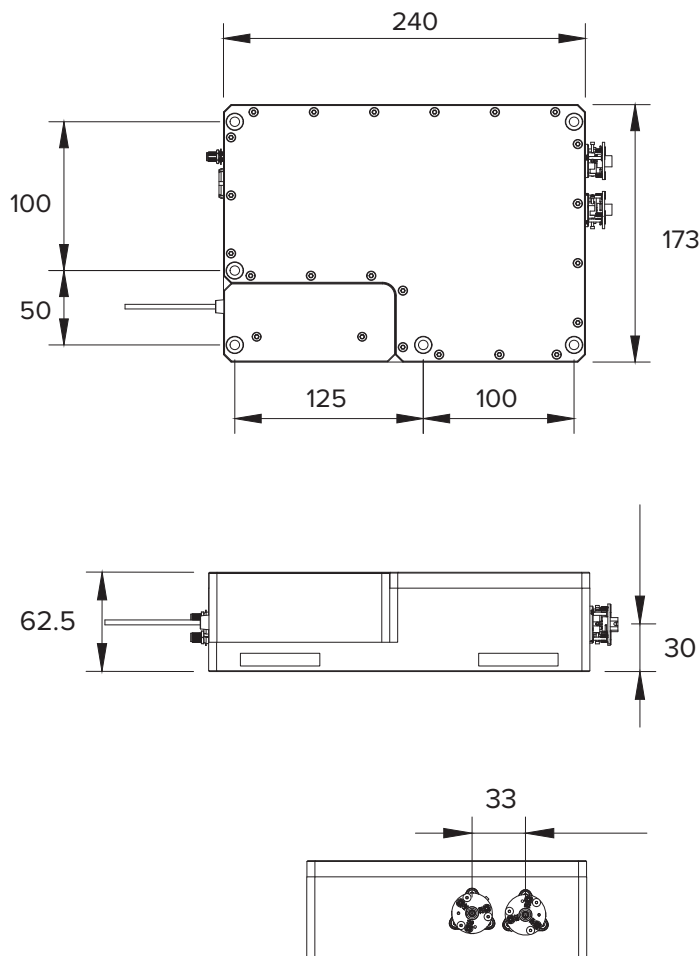
HARMONIK module <sup>1)</sup>	
Power supply requirements [VAC, Hz]	100-240 VAC, 50-60 Hz
Digital interface	Ethernet 10/100
Monitor output	Standard: Free-space Optional: Fiber FC/APC, 2.5 m
Dimensions (WxHxL) [mm <sup>3</sup> ]	173 x 62.5 x 240
Weight [kg]	6

1) For the BOOSTIK system, please refer to the BOOSTIK datasheet.

## Reliability

The Koheras range of single frequency fiber lasers is based on telecom-grade fiber components and built to last thousands of hours with no service or maintenance.

With several thousand lasers installed in environments varying from fully climate controlled national standards laboratories to the demanding environment on oil rigs and submarines, the Koheras line is the most robust single-frequency laser range on the market with an unmatched reliability track record.



All Koheras products are produced under our quality management system certified in accordance with the ISO 9001:2015.

