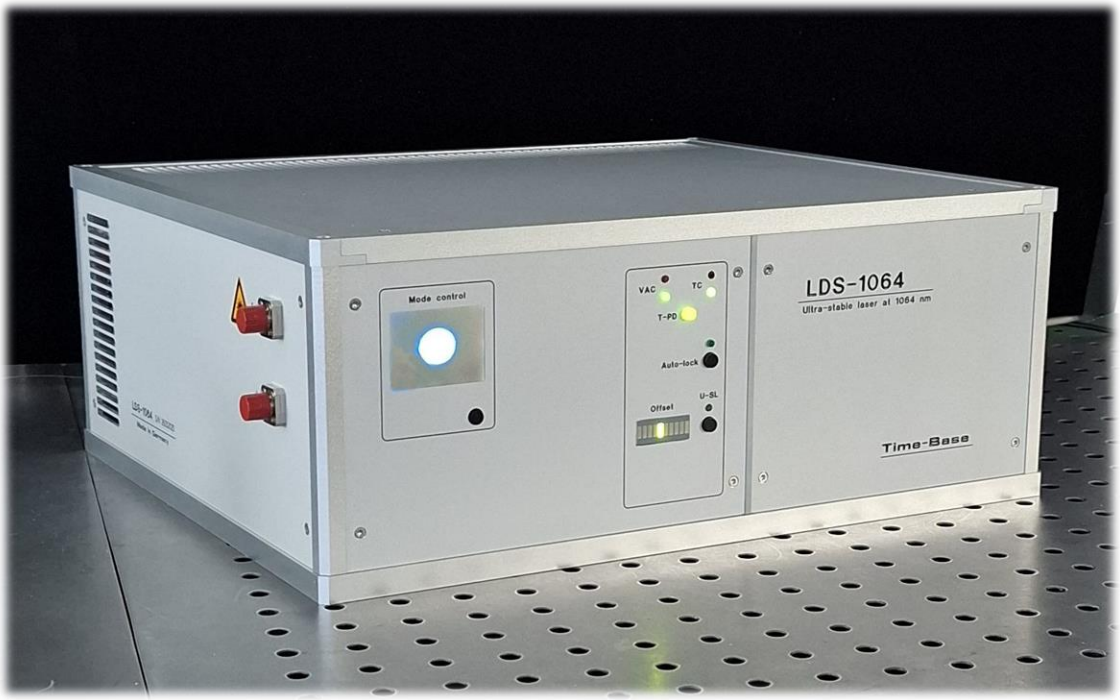
LDS-1064

Ultra-compact narrow-linewidth laser system at 1064 nm



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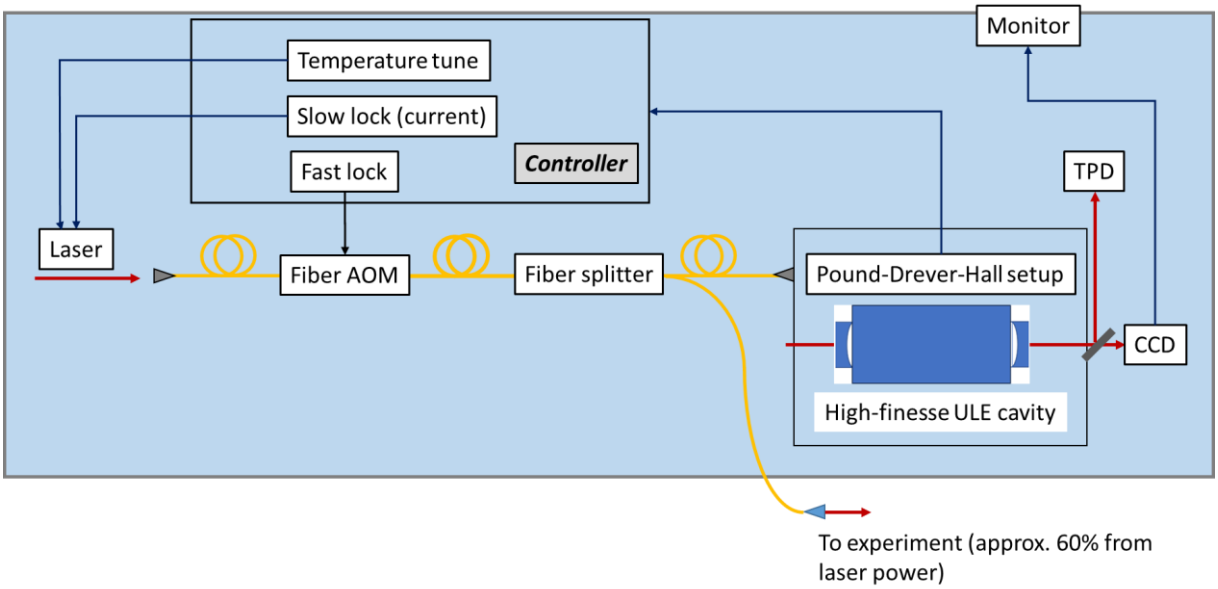
General description.

The **LDS-1064** is an ultra-compact turn-key system based on a 1064 nm laser, frequency stabilized to a high-finesse ULE optical resonator using the Pound-Drever -Hall technique. The use of a fast fiber-integrated AOM allows fast frequency corrections of the laser thus enabling tight and stable frequency locking of almost any commercial single-frequency laser. The laser can be placed externally or integrated inside the housing. Currently the system is designed for integration of the 1064 nm RIO – Orion laser module (Luna Innovation/Rio), or the Koheras BASIK single-frequency fiber laser (NKT Photonics) in the range of 1030 - 1120 nm.

LDS-1064 Layout



LDS-1 main components

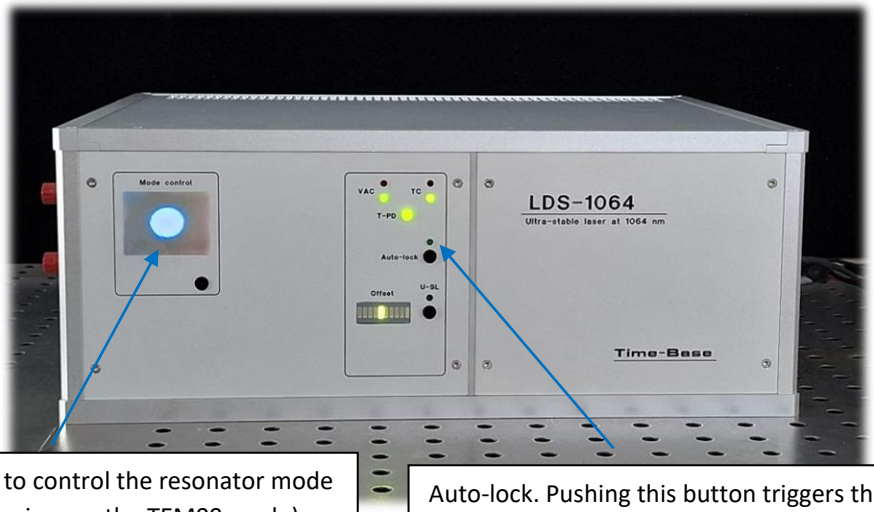
Optical unit:

- High-finesse (< 120 000) ULE optical resonator with a vibration reduced shape. Length 76 mm, operation at zero CTE.
- Aluminum vacuum chamber with a 2 l/s ion getter pump. Vacuum better $6x10^{-8}$ mbar.
- Miniature vacuum pump controller with an additional Blue-tooth (smartphone) interface
- In-vacuum heat shields for the resonator
- Active temperature stabilization of the ULE resonator at the temperature of zero CTE using TEC elements. Long-term temperature stability approx. 1 mK
- Fiber AOM with a PM fiber splitter at the output (10% for stabilization, 90% for experimentation)
- Low-RAM bulk electro-optical phase modulator for Pound-Drever-Hall signal generation
- Compact resonator incoupling and PDH setup
- Fast reflection amplified InGaAs photodetector
- Amplified photodetector for transmission signal
- CCD camera at the output of the resonator to monitor the resonator modes
- TFT display to control the resonator mode (TEM00 mode is optimized).

Controller:

- Precision RF AOM driver with a wide bandwidth FM for laser frequency stabilization
- DDS-based RF driver for EOM Pound-Drever-Hall electronics with a digital phase adjustment
- Ultra-low noise analog PID controller with fast and slow loops for laser frequency stabilization
- Microcontroller-based auto-lock frequency stabilization system including digital correction of the laser temperature (long-term frequency correction)
- Computer control

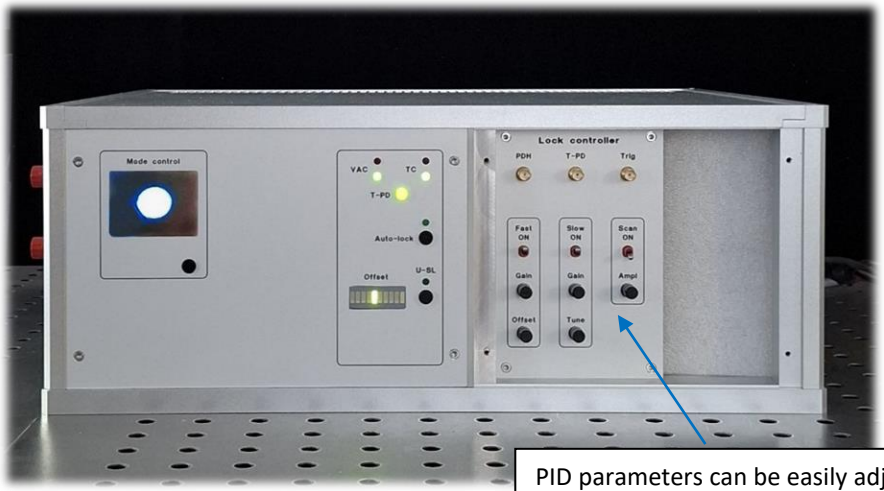
Front view



TFT monitor to control the resonator mode (in the picture is seen the TEM00 mode)

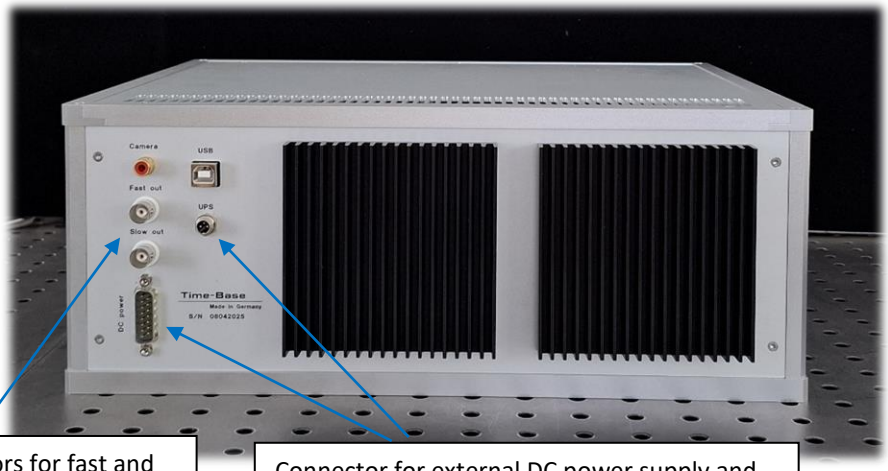
Auto-lock. Pushing this button triggers the microcontroller to scan the laser frequency, find the resonator mode and enable frequency lock.

Built-in precision analog Lock-Box



PID parameters can be easily adjusted on the PCB (behind the front panel).

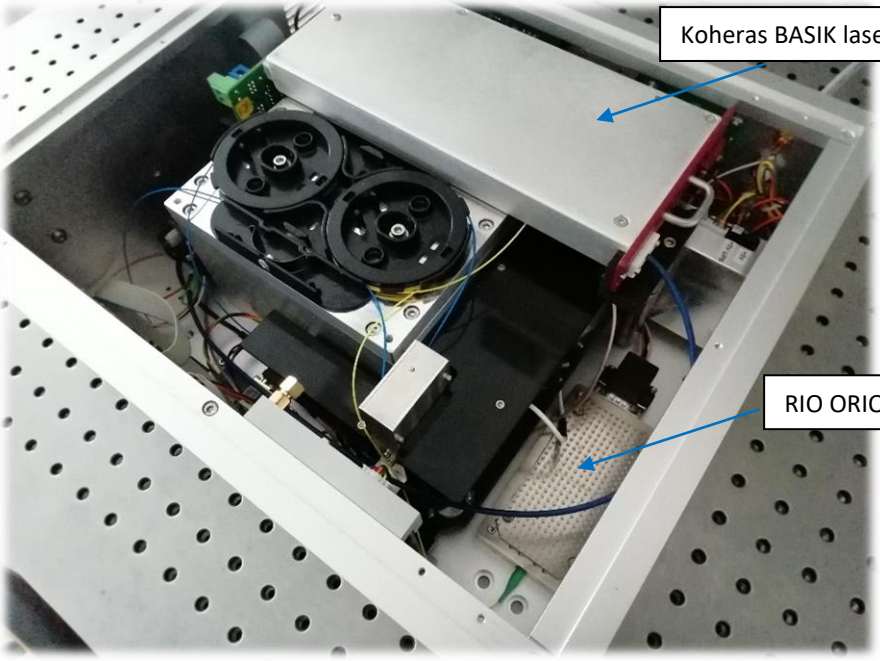
Rear view

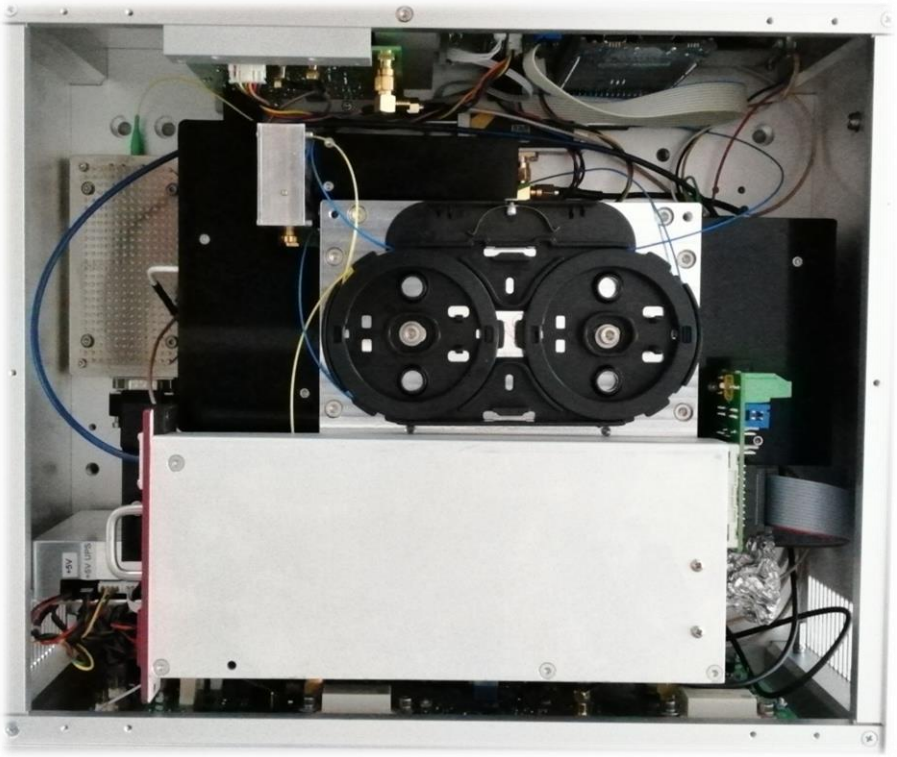


BNC connectors for fast and slow lock of an external laser

Connector for external DC power supply and UPS (uninterruptible power supply)

Integration of RIO-Orion and Koheras BASIK lasers





Specifications:

Dimensions (mm)	350 x 300 x 140 (L x W x H)
Weight (without external power supply)	13.5 kg
Power consumption	20 W
Power supply (external)	+24V, ±5V
Laser linewidth	< 10 Hz (without vibration isolation)
Output power (implemented 1064 nm RIO ORION laser)	> 20 mW

Typical frequency stability measurements by analyzing the heterodyne beat signal between two similar LDS-1064 systems (without vibration isolation):