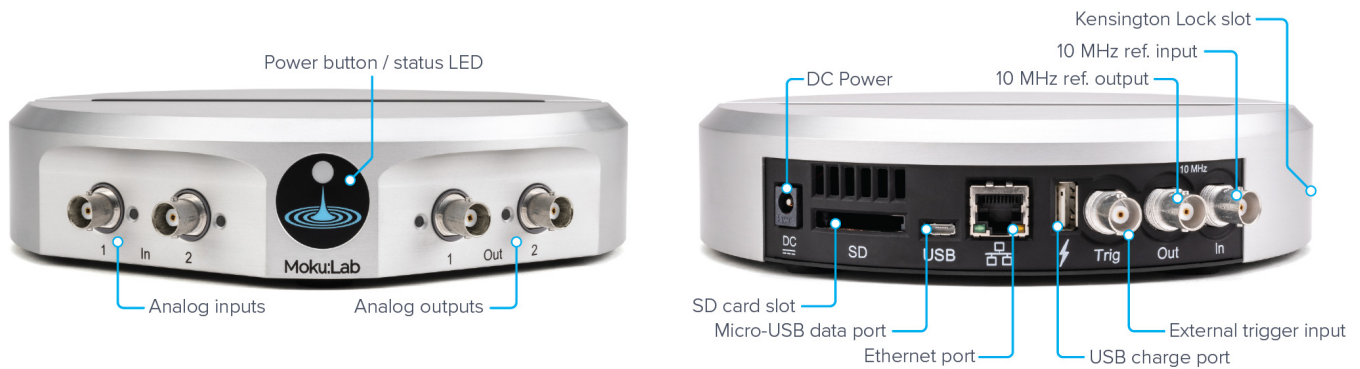# Moku:Lab

Fourteen instruments, one hardware platform

Moku:Lab is a reconfigurable hardware platform that combines the digital signal processing power of an FPGA with versatile low-noise inputs and outputs. Simplify your workflow with access to 14 high-performance instruments that enable you to measure what you need, when you need. The analog front end is designed for maximum versatility. Configure two 500 MSa/s inputs for AC or DC coupling, 50 Ω or 1 MΩ impedance, and an input voltage range of 1 Vpp or 10 Vpp. Moku:Lab also features two 1 GSa/s outputs with 300 MHz anti-aliasing filters, allowing you to generate two high-precision waveforms while measuring on its inputs. Powered by the Xilinx Zynq 7020, Moku:Lab is an ideal solution for research applications.

Power button / status LED
Analog inputs
Analog outputs

Kensington Lock slot
10 MHz ref. input
10 MHz ref. output
DC Power
SD card slot
Micro-USB data port
Ethernet port
USB charge port
External trigger input

Analog inputs **2 channels, 500 MSa/s**	Input bandwidth **200 MHz**	Analog outputs **2 channels, 1 GSa/s**	Output bandwidth **300 MHz**	Onboard FPGA **Xilinx Zynq 7020 Series**

14 Powerful Instruments

- Arbitrary Waveform Generator
- Data Logger
- Digital Filter Box
- FIR Filter Builder
- Frequency Response Analyzer
- Laser Lock Box
- Lock-in Amplifier
- Logic Analyzer/Pattern Generator
- Oscilloscope
- Phasemeter
- PID Controller
- Spectrum Analyzer
- Time & Frequency Analyzer
- Waveform Generator

Highlights

- Better than 30 nV/√Hz noise performance above 100 kHz
- 500 ppb stability onboard clock
- < 1 μs input to output latency
- Class-leading, multi-touch user interface with the option for wireless connection

Specifications

Two analog inputs
- 12-bit, 500 MSa/s ADCs
- 200 MHz input bandwidth
- AC or DC coupling
- 50 Ω or 1 MΩ input impedance
- 1 Vpp or 10 Vpp input range

Two analog outputs
- 16 bit, 1 GSa/s DACs
- 2 -pp output range into 50 Ω

Additional I/O
- Dedicated trigger input
- 10 MHz synchronization in and out
- Onboard Wi-Fi, Ethernet, and USB
- SD card for data storage

Programming environment
- API support for Python, MATLAB, and LabVIEW

Applications

- Signal monitoring and analysis
- Automated test sequence
- Circuit design and characterization
- Frequency domain signal analysis
- Complex impedance measurement
- System prototyping and simulation
- Closed-loop control design
- Optical metrology and spectroscopy

For full specifications, please visit www.liquidinstruments.com

Multi-instrument Mode

Multi-instrument Mode on Moku:Lab allows users to run two instruments simultaneously to create custom test configurations. Each instrument has full access to the analog inputs and outputs along with adjacent instrument slots. The slots are connected by a low-latency, real-time 12.5 Gb/s signal path, so instruments can run independently or connected together to build sophisticated signal processing pipelines. Dynamically swap instruments in and out without interrupting adjacent instruments. For advanced applications, deploy custom algorithms in Multi-instrument Mode using Moku Cloud Compile.

Integrated Laser Lock Box

The Pound-Drever-Hall (PDH) technique is a widely used method to match the emitting optical frequency of a laser to an optical cavity. To perform PDH locking, several dedicated and custom-made electronic instruments are required including signal generators, mixers, and low pass filters. The Moku:Lab Laser Lock Box integrates most of the PDH electronics into a single, compact, easy-to-use instrument which provides high-precision laser frequency locking. It also includes a Lock Assist mode that can automatically lock to a chosen resonance within seconds using its integrated scan signal generator and PID controllers. The Laser Lock Box also supports other laser locking techniques such as fringe-side locking, tilt locking, and RF locking.
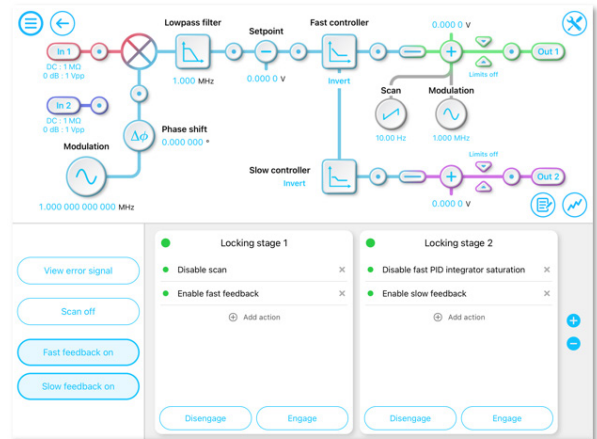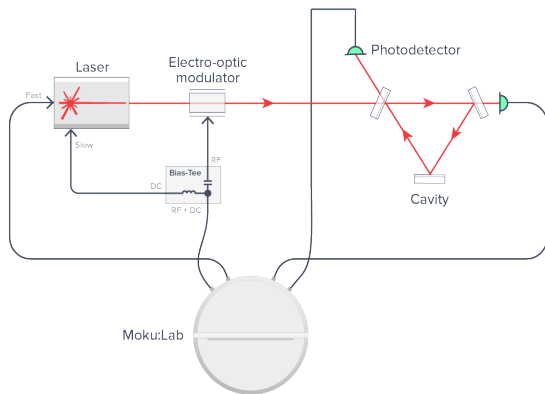
200 MHz Lock-in Amplifier

The Moku:Lab digital Lock-in Amplifier supports dual-phase demodulation (X/Y and R/θ) from DC to 200 MHz, with more than 120 dB of dynamic reserve. Demodulation signals can be generated by the onboard Waveform Generator or from an external signal. The two high-speed analog outputs can be assigned to output X, Y, R, θ, and local oscillator to drive an external device. The built-in probe points allow you to monitor and log the signal at various DSP stages. Optional PID controllers are available for closed-loop control and phase-locked loop applications.