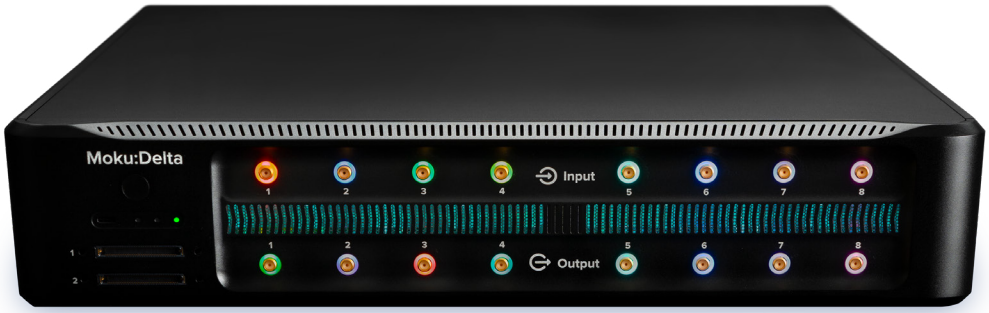
Moku:Delta

Precision meets speed and adaptability in one reconfigurable platform.

Moku:Delta is a versatile, high-performance, software-defined test and measurement platform, purpose-built for precision, flexibility, and real-time performance. It features eight 2 GHz 14-bit and 20-bit analog inputs, eight 2 GHz 14-bit analog outputs, and 32 bidirectional digital I/O channels. Powered by a Xilinx® UltraScale+™ RFSoC FPGA, Moku:Delta supports integrated signal processing, control, analysis, and waveform synthesis in a single cohesive platform. The ultra-stable, 1 ppb, onboard reference clock and advanced timing options, including 10 MHz, 100 MHz, and GPS-disciplined references, ensure accurate synchronization. Moku:Delta enables engineers and scientists to develop test systems that combine high-performance instrumentation with user-defined, hardware-accelerated algorithms.



Analog inputs	Input bandwidth	Analog outputs	Output bandwidth	Connectivity*	Clock reference options
8-channel, 5 GSa/s	**Up to 2 GHz**	**8-channel, 10 GSa/s**	**Up to 2 GHz**	**Ethernet, SFP, QSFP, USB-C**	**10 MHz, 100 MHz, GPS**

Specifications

Eight analog inputs

- 14-bit and 20-bit ADCs with frequency-dependent blending
- 5 GSa/s sampling rate on all eight channels simultaneously
- Input noise: < 10 nV/√Hz
- AC and DC coupling, 50 Ω and 1 MΩ input impedance
- 100 mVpp, 1 Vpp, 10 Vpp, and 40 Vpp input range

Eight analog outputs

- 14 bit DACs
- 10 GSa/s sampling rate
- Output range (into 50 Ω):
  - ± 500 mV up to 2 GHz
  - ± 5 V up to 100 MHz

Additional I/O

- 2 sets of 16 bidirectional DIO pins
- TTL trigger input
- External clock reference input and output
- Ultra-high speed connectivity: 100 Gb/s QSFP**, two 10 Gb/s SFP, 1 Gb/s Ethernet
- GPS timing reference module

*Optional, removable WiFi connectivity via an external adapter

**Subject to export control and restrictions

Hardware highlights

- Exceptional low-frequency noise performance: 500 µV RMS noise at full input bandwidth
- 1 ppb onboard clock stability
- Internal 1 TB SSD for data logging and deep memory captures
- Input - output delay: < 450 ns

A suite of powerful instruments

- Arbitrary Waveform Generator
- Custom Instrument
- Data Logger
- Digital Filter Box
- FIR Filter Builder
- Frequency Response Analyzer
- Gigabit Streamer
- Laser Lock Box
- Lock-in Amplifier
- Logic Analyzer
- Neural Network
- Oscilloscope
- Phasemeter
- PID Controller
- Spectrum Analyzer
- Time & Frequency Analyzer
- Waveform Generator

Programming environments

- Integrated system: MokuOS 4
- Intuitive Windows, macOS, iPadOS, and visionOS apps
- Full API support is available for major languages, including Python and MATLAB
- Program the onboard FPGA in VHDL or Verilog for custom, real-time signal processing

Applications

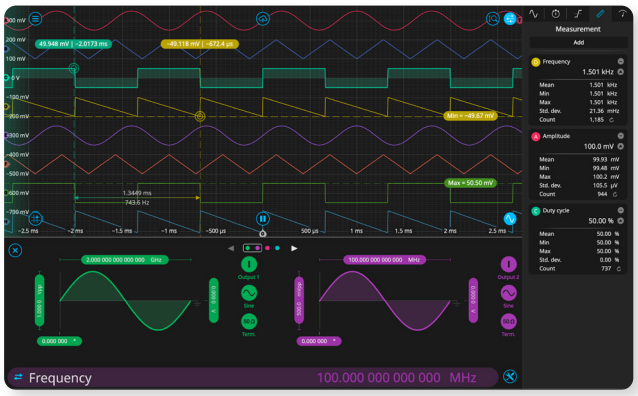
- Optical metrology and spectroscopy
- Quantum computing
- Cold-atom and quantum optics experiments
- Multi-harmonic or multi-system detection
- System prototyping and simulation
- Automated test sequencing
- Closed-loop control design
- Synchronized Waveform Generators and receivers for phased-array, MIMO applications
- High-bandwidth data streaming to network storage
- High-frequency mixed domain analysis
- Implementing real-time Neural Networks

For full specifications and ordering, contact sales@liquidinstruments.com.

Deploy up to eight instruments simultaneously

Multi-Instrument Mode on Moku:Delta runs up to eight instruments simultaneously, so you can create custom test sequences and complex measurement workflows. Each instrument has full access to all analog inputs, outputs, and adjacent instrument slots. A low-latency, real-time up to 80 Gb/s signal path connects the slots, enabling independent operation or tightly integrated signal processing pipelines. Swap instruments in and out dynamically as needed, or deploy your own custom algorithms using Moku Compile for advanced, application-specific functionality.

The highest bit-depth 2 GHz Oscilloscope



With eight analog inputs sampled simultaneously at 14 bits and 5 GSa/s, Moku:Delta delivers a new performance benchmark for precision signal acquisition. A dedicated 20-bit, 40 MSa/s path with advanced frequency-dependent ADC blending achieves a noise floor below 10 nV/√Hz, unlocking exceptional dynamic range and low-noise performance across the entire device bandwidth. With four 10 GSa/s DACs and 32 digital I/O channels, Moku:Delta supports precise signal synthesis and complex mixed-signal test scenarios.

2 GHz Lock-in Amplifier

The Moku:Delta digital Lock-in Amplifier performs dual-phase demodulation (X/Y or R/θ) from DC up to 2 GHz, with over 120 dB of dynamic reserve. Demodulate using the onboard local oscillator or phase-lock to an external reference at the fundamental, harmonic, or subharmonic. Blended ADC technology delivers a consistently low noise floor across the full 2 GHz input bandwidth. Built-in probe points make it easy to monitor and log signals at key stages of processing. A built-in PID Controller supports closed-loop control and phase-locked loop applications.