Moku:Lab Version 3.0 Migration Guide

Upgrading Moku:Lab to software version 3.0 unlocks a host of new features. This guide details the steps involved in migrating, new features, and backward compatibility limitations.

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INSTRUMENTS

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Overview

Moku:Lab software version 3.0 is a major update that brings new firmware, user interfaces, and APIs to Moku:Lab hardware. The update brings Moku:Lab in line with Moku:Pro and Moku:Go, making it easy to share scripts across all Moku platforms and maintain a consistent user experience. This means that users must rewrite their Moku:Lab Python, MATLAB, and LabVIEW user scripts to ensure compatibility with Moku: software version 3.0 APIs. The update unlocks a host of new features to many of the existing instruments. It also adds two new features: Multi-instrument Mode and Moku Cloud Compile.

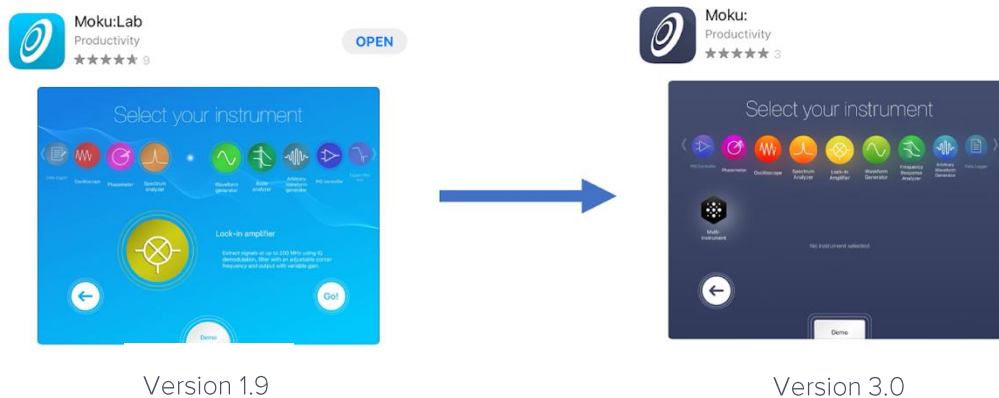Version 1.9   Version 3.0

Figure 1: Moku:Lab iPad users will need to install the Moku: app,
which currently supports Moku:Pro.

To access Moku: version 3.0, download it on the Apple App Store for iPadOS, or from our software download page for Windows and macOS. The legacy Moku:Lab app is named Moku:Lab. With version 3.0, Moku:Lab now runs on the Moku: app, supporting both Moku:Lab and Moku:Pro. For assistance upgrading your software or to downgrade back to version 1.9 at any time, please contact support@liquidinstruments.com.

Version 3.0 new features

New features

Software version 3.0 brings Multi-instrument Mode and Moku Cloud Compile to Moku:Lab for the first time, as well as many performance and usability upgrades across the suite of instruments. No purchase is required for this update, bringing new capabilities to users' existing Moku:Lab instruments at no cost.

Multi-instrument Mode

Multi-instrument Mode on Moku:Lab allows users to deploy two instruments simultaneously to create a custom test station. Each instrument has full access to the analog inputs and outputs, along with interconnections between instrument slots. The interconnections between instruments support high-speed, low-latency, real-time digital communication up to 2 Gb/s, so instruments can run independently or be connected to build advanced signal processing pipelines. Users can

dynamically swap instruments in and out without interrupting the other instrument. Advanced users can also deploy their own custom algorithms in Multi-instrument Mode using Moku Cloud Compile.

Moku Cloud Compile

Moku Cloud Compile allows you to deploy custom digital signal processing (DSP) directly onto the Moku:Lab FPGA in Multi-instrument Mode. Write code using a web browser and compile it in the cloud; then use Moku Cloud Compile to deploy the bitstream to one or more target Moku devices. Find Moku Cloud Compile examples here.

Oscilloscope

- Deep memory mode: capture up to 4M samples per channel at the full sampling rate (500 MSa/s)

Spectrum Analyzer

- Improved noise floor
- Logarithmic Vrms and Vpp scale
- Five new window functions (Bartlett, Hamming, Nuttall, Gaussian, Kaiser)

Phasemeter

- Users can now output frequency offset, phase, and amplitude as analog voltage signals
- Users can now add DC offset to output signals
- The phase-locked sine wave output can now be frequency multiplied up to 250x or divided down to 0.125x
- Improved PLL bandwidth (1 Hz to 100 kHz)
- Advanced phase wrapping and auto-reset functions

Waveform Generator

- Noise output
- Pulse width modulation (PWM)

Lock-in Amplifier (LIA)

- Improved performance of low-frequency PLL locking
- The minimum PLL frequency has been decreased to 10 Hz
- The external (PLL) signal can now be frequency multiplied up to 250x or divided down to 0.125x for use in demodulation
- 6-digit precision for phase values

Frequency Response Analyzer

- Maximum frequency increased from 120 MHz to 200 MHz
- Increased maximum sweep points from 512 to 8192
- New Dynamic Amplitude feature optimizes output signal automatically for best measurement dynamic range
- New In/In1 measurement mode
- Input saturation warnings

- The math channel now supports arbitrary complex-valued equations involving the channel signals, enabling new types of complex transfer function measurements
- Users can now measure input signals in dBVpp and dBVrms in addition to dBm
- The progress of the sweep is now displayed on the graph
- The frequency axis can now be locked to prevent accidental changes during a long sweep

Laser Lock Box

- Improved block diagram shows scan and modulation signal paths
- New locking stages feature allows users to customize their lock procedure
- 6-digit precision for phase values
- Improved performance of low-frequency PLL locking
- Minimum PLL frequency decreased to 10 Hz
- The external (PLL) signal can now be frequency multiplied up to 250x or divided down to 1/8x for use in demodulation

Other

- Added support for the sinc function to the equation editor which can be used to generate custom waveforms in the Arbitrary Waveform Generator
- Convert binary LI files to CSV, MATLAB, or NumPy formats when downloading from the device
- Increased support on Windows, macOS, and iOS apps. An iPad is no longer required for any Moku:Lab instrument. The same iPad app now controls both Moku:Lab and Moku:Pro.

Upgraded API support

The new Moku API package provides enhanced functionality and stability. It will receive regular updates to improve performance and introduce new features.

Summary of changes

Users are encouraged to review all changes and compatibility issues before upgrading. Changes from software version 1.9 to 3.0 are categorized as:

- **Minor**: no user impact
- **Medium**: some user impact
- **Major**: users should carefully review to understand necessary changes if updating

App name

Minor change

The iPadOS name was previously Moku:Lab. Software upgrade 3.0 brings Moku:Lab to the Moku: app.

Action

Users must download the new app, Moku:, from the Apple App Store.

iOS version

Medium change

Moku:Lab app 1.9 requires iOS8 or later while Moku: app 3.0 requires iOS 14 or later. Some older iPad models are no longer supported by the Moku: app, including iPad mini 2 and 3, iPad 4, and iPad Air 1. These iPad models have been obsoleted by Apple. Learn how to identify your iPad model here.

Action

Users must review their iPad model number. If it is an unsupported model, users are required to upgrade their iPad if they would like to use the Moku: iPad app. Users can also choose to use the desktop app instead.

Windows version

Medium change

The current 1.9 Windows app is named Moku:Master. Moku:Master requires Windows 7 or later. Moku: v3.0 requires Windows 10 (version 1809 or later) or Windows 11.

Action

Review your current Windows version. If necessary, upgrade to Windows 10 version 1809 or later or Windows 11 to use Moku: v3.0.

Data logging to CSV

Medium change

Moku:Lab version 1.9 allowed data logging directly to .CSV format. In version 3.0, data is logged to .LI format only. The Moku: app provides a built-in converter or a separate file converter allowing users to convert .LI to .CSV, MATLAB, or NumPy.

Action

Use the built-in converter or standalone file converter.

Waveform Generator

Medium change

In Moku:Lab version 1.9, the Waveform Generator can use channel two as a trigger or modulation source. The output does not need to be on for this feature to operate. In version 3.0, the second channel must be on in order to use it as a trigger or modulation source.

Action

If you are using the second Waveform Generator channel as a trigger or cross modulation source, ensure no other devices are attached to the output of the second channel.

French and Italian languages

Medium change

Moku:Lab version 1.9 supported French and Italian, while version 3.0 does not support these languages.

Data logging to RAM

Major change

Impacted instruments of this change include the Data Logger and built-in Data Logger in the Digital Filter Box, FIR Filter Builder, Lock-in Amplifier, and PID Controller. Moku:Lab v1.9 allowed high-speed data logging to internal Moku:Lab RAM at up to 1 MSa/s. Data logging to RAM is currently not supported in Moku: v3.0. Moku: v3.0 supports only data logging to an SD card. This limits data logging speed to approximately 250 kSa/s for one channel, and 125 kSa/s for two channels.

Action

Review data logging speed requirements. If logging at greater than 250 kSa/s is required for your application, consider remaining with Moku:Lab version 1.9 until a future version.

Phasemeter data logging

Major change

Moku:Lab version 1.9 allowed for the Phasemeter to log to internal Moku:Lab RAM at up to 125 kSa/s. Moku: version 3.0 currently solely supports data logging to an SD card at up to 15.2 kSa/s.

Action

Review data logging speed requirements in applications using the Phasemeter instrument.

APIs

Major change

Moku supports API access with MATLAB, Python, and LabVIEW. Version 3.0 contains upgraded API support, but it is not backward compatible with version 1.9 APIs. Any APIs used with version 1.9 will require significant rework. Please refer to the API migration guides for more information.

Action

Review changes needed to API scripts and refer to the API migration guides.

Downgrade process

If the upgrade to 3.0 has proven to limit, or otherwise adversely affect, something critical to your application, you can downgrade to the previous version 1.9. This can be done through a web browser.

Steps

1. Contact Liquid Instruments and obtain the file for firmware version 1.9.
2. Type your Moku:Lab IP address into a web browser (see Figure 2).
3. Under Update Firmware, browse and select the firmware file provided by Liquid Instruments.
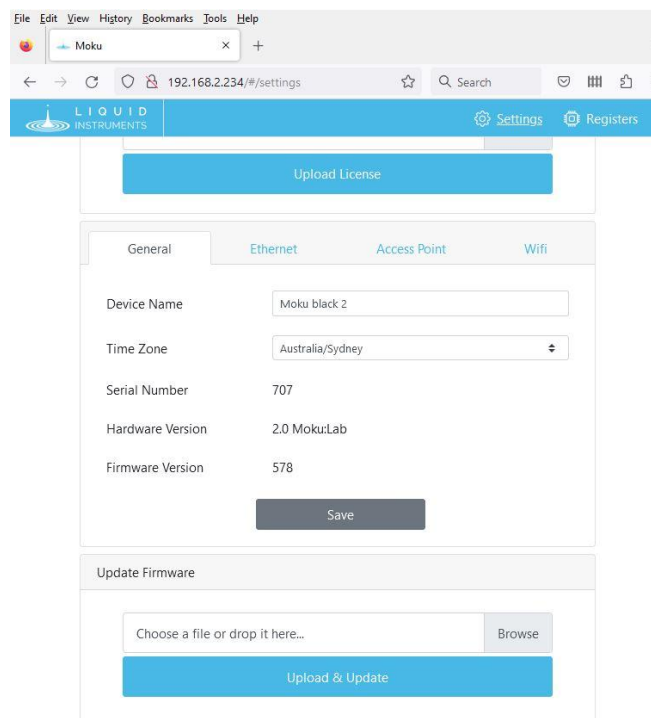4. Select Upload & Update. The update process can take more than 10 minutes to complete.

Figure 2: Moku: downgrade procedure