

Lock-in Amplifiers

Generate, Control & Analyze



Our lock-in amplifiers measure vanishingly small periodic voltage and current signals, and offer class-leading noise rejection and phase sensitivity for applications at frequencies from DC to 8.5 GHz.

Measure at multiple frequencies simultaneously, or at mixed frequencies. Tune to get the best balance between noise rejection and measurement speed. Fast data transfer rates and multiple outputs make a great match for standalone operation or integration with larger setups.

The LabOne® control software simplifies workflows and provides tools you can trust to deliver results. In addition to the lock-in amplifier, it includes an oscilloscope with FFT, a parametric sweeper, a spectrum analyzer, and much more. All tools can be used simultaneously.

All functionality and data acquisition can be accessed via APIs for ease of integration: LabVIEW™, MATLAB®, C, .NET and Python.

Low input noise, wide analysis bandwidth and a fast time constant make our lock-in amplifiers the ideal measurement tool for the most demanding applications.

Key Benefits

- Discover more from your signals with time- and frequency-domain analysis
- Explore new aspects of your experiment with multi-frequency measurements
- Get the most from your signals by implementing feedback schemes directly on the instrument
- Reduce your setup complexity by combining tools within one instrument
- Seamlessly integrate LabOne® into your setup with a range of APIs
- Orchestrate CW and pulsed measurement sequences with the LabOne® Timeline Module

Applications

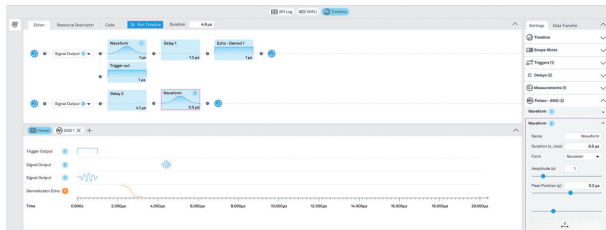
- Sensors & quantum sensing
- Optics & photonics
- Spin qubits
- Scanning probe microscopy
- Materials science & nanotechnology
- Semiconductors & failure analysis
- Cavity optomechanics



Timeline Module

Orchestrate your experiment

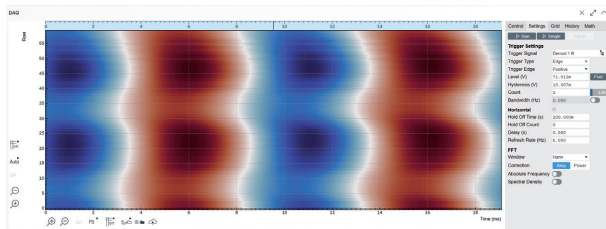
- Build continuous and sequenced experiments
- Configure pulses, triggers and acquisitions
- Save time with graphical programming & monitoring
- Switch to scripting to integrate workflows



Data Acquisition

Trigger and acquire only the data you need

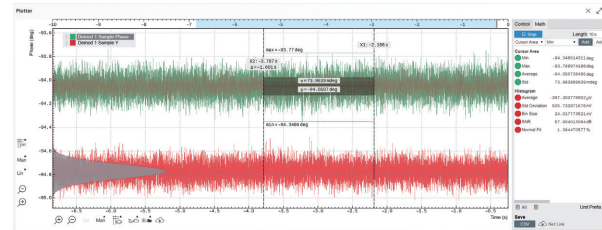
- Stream & trigger data at a high data rate
- Capture multiple data sources in parallel
- Convert your traces into 2D images directly
- Export data in CSV, MAT, HDF5®, PNG or SVG



Plotter

Real-time view of signals for easy setup

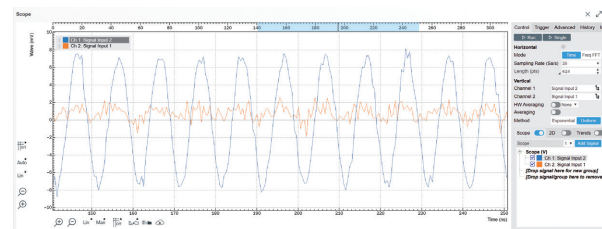
- View the time evolution of your measurement
- Use analysis tools to measure in real time
- Monitor signal trends such as mean or SNR
- View multiple signals simultaneously



Scope

Verify incoming signals to optimise your measurement

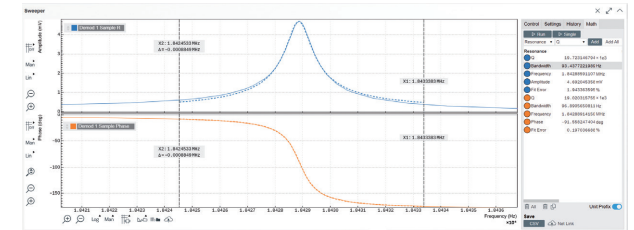
- Dual-channel oscilloscope
- Cross-domain triggering
- Time- and frequency-domain views
- Multiple sources including signal and trigger



Sweeper

Understand the frequency response of your sample

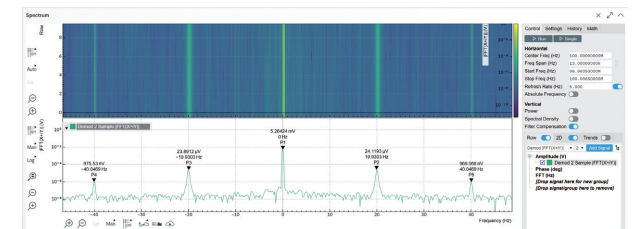
- Quickly characterize amplitude and phase
- Directly read off key parameters
- Save time by acquiring multiple signals in parallel
- Sweep and acquire a wide range of parameters



Spectrum

Hunt unwanted signals and noise to boost your SNR

- Fast, high-resolution FFT spectrum analyzer
- Multiple spectrum modes
- Amplitude, spectral density & power spectrum
- Find and measure unwanted signals in the loop



Optional Upgrades

All upgrades can be added without returning the instrument.

Multi-Frequency Operation



Measure and generate multiple arbitrary frequencies simultaneously.

- Measure multiple frequencies simultaneously
- 2 external reference PLLs
- Increased number of demodulators & oscillators
- Combine multiple signals from one output

Arbitrary Waveform Generator

GHFLI, UHFLI, VHFLI



Generate the signals you need with high resolution.

- Dual-channel AWG with digital modulation capability
- Full integration with the LabOne® Timeline Module
- Optimal phase coherence and minimal jitter
- Direct or amplitude modulation output

Modulation Analysis



Measure and control frequency components of your modulated signals.

- Measure carrier & sidebands of AM/FM signals
- Avoid limitations of tandem demodulation
- Individually configure each frequency component
- Measure 2 phase-coherent linear combinations

Boxcar Averager

MFLI, UHFLI



Maximize the SNR of your low-duty-cycle signals.

- Reject non-periodic signal components
- Baseline suppression
- Zero acquisition dead time
- Simultaneous operation with other LabOne® tools

Digitizer

MFLI, VHFLI



Enhance the time-domain capabilities of your lock-in amplifier.

- Dual-trace oscilloscope with FFT
- Increased memory per channel
- Fast continuous data streaming
- Measure voltage and current simultaneously

Quad PID/PLL Controllers



Create advanced feedback loops controllers for your I/O signals.

- 4 PID controllers integrated into your lock-in
- Loop filter bandwidth up to 300 kHz
- Tune quickly with the Advisor and Auto Tune
- $\pm 1024\pi$ phase unwrap for reliable operation

Impedance Analyzer

MFLI



Add impedance characterization without adding complexity.

- 0.05% basic accuracy down to 1 mHz
- Wide impedance range: 1 m Ω to 1 T Ω
- Fast LCR mode: 10 μ s per datapoint at 1 MHz
- Compensation routine for third-party fixtures

Frequency Extension

MFLI, VHFLI



Explore higher frequency domain of your experiment.

- Extends the frequency range of your instrument
- Field-upgradeable option
- Independent from the set of installed options
- Does not affect the other specifications

Pulse Counter

UHFLI



Solve your pulse-counting needs with 4 independent counting units.

- Measure 4 event trains via 5 operation modes
- 225 MHz maximum count rate
- Discriminator level & background subtraction
- Enable ultra-fast feed-forward loops with AWG

Specifications

MFLI



VHFLI



UHFLI



GHFLI



SHFLI



Signal Inputs/Outputs

Frequency range	DC to 500 kHz / 5 MHz	DC to 50 MHz / 200 MHz	DC to 600 MHz	DC to 1.8 GHz	DC to 8.5 GHz
Input impedance	50 Ω or 10 M Ω	50 Ω or 10 M Ω	50 Ω or 1 M Ω	50 Ω	50 Ω
Minimum input noise	2.5 nV / $\sqrt{\text{Hz}}$	3 nV / $\sqrt{\text{Hz}}$	4 nV / $\sqrt{\text{Hz}}$	3.5 nV / $\sqrt{\text{Hz}}$	2.5 nV / $\sqrt{\text{Hz}}$
Dynamic reserve	120 dB	120 dB	100 dB	100 dB	100 dB
Input range (peak amplitude)	1 mV to 3 V	5 mV to 2 V	10 mV to 1.5 V	10 mV to 1 V	1 mV to 1 V

Demodulators & Reference

Number of demodulators	1 dual-phase (4 with MF-MD)	2 dual-phase (8 with MF-MD)	8 dual-phase	8 dual-phase	8 dual-phase
Number of oscillators	1 (4 with MF-MD)	2 (8 with VHFLI-MF)	2 (8 with UHF-MF)	2 (8 with GHF-MF)	2 (8 with SHF-MF)
Output sample rate	up to 200 kSa/s	up to 25 MSa/s burst	up to 1.6 MSa/s	up to 50 MSa/s (burst)	up to 50 MSa/s (burst)
Time constant	337 ns to 83 s	14 ns to 21 s	30 ns to 76 s	14 ns to 21 s	14 ns to 21 s
Measurement bandwidth	276 μHz to 206 kHz	3.2 MHz to 11 MHz	628 μHz to 5 MHz	3.2 MHz to 11 MHz	3.2 MHz to 11 MHz
Filter order	up to 8th	up to 4th	up to 8th	up to 4th	up to 4th
Reference & trigger	2 inputs, 2 outputs	2 inputs, 2 outputs	2 inputs, 2 outputs, 2 I/O	4 inputs, 2 outputs	4 inputs, 4 outputs

Auxiliary & Other

Auxiliary outputs	4 BNC, ± 10 V, 18 bit, 612 kSa/s	4 BNC ± 10 V, 14 bit > 50 MHz	4 BNC, ± 10 V, 16 bit, 28 MSa/s	4 BNC, ± 4 V, 18 bit, 1 MSa/s 4 BNC, ± 4 V, 14 bit, 50 MSa/s	4 BNC, ± 4 V, 18 bit, 1 MSa/s 4 BNC, ± 4 V, 14 bit, 50 MSa/s
Auxiliary inputs	2 BNC, ± 10 V, 16 bit, 15 MSa/s	2 BNC ± 10 V, 14 bit > 150 MHz BW	2 BNC, ± 10 V, 16 bit, 400 kSa/s	2 SMA, ± 1.5 V, 14 bit, 4 GSa/s	2 SMA, ± 1.5 V, 14 bit, 2 GSa/s
Connectivity	USB 2.0, LAN 1 GbE	USB 3.0, LAN 1 GbE	USB 2.0, LAN 1GbE	USB 3.0, LAN 1GbE	USB 3.0, LAN 1GbE

Your Notes

