HF2LI
Lock-in Amplifier

Zurich Instruments

2 Input Channel, 2 Generator, 50 MHz Lock-in Amplifier

Product Specification
Release date: February 2011

Key Features

- 210 MSample/s, 0.7 µHz - 50 MHz bandwidth
- 2 independent lock-in units, 2 signal generators
- 1 fundamental and 2 harmonic frequencies per lock-in unit
- 4 auxiliary outputs, 2 auxiliary inputs
- USB 2.0 high-speed, 480 Mbit/s
- Frequency response sweeper and oscilloscope
- Software included free of charge: graphical user interface, 3 programming interfaces, data server

Summary

The Zurich Instruments HF2LI (high-frequency, 2 inputs) is a digital lock-in amplifier covering the frequency range between 0.7 µHz and 50 MHz. It features 2 physical input channels so that it can replace 2 devices in many measurement setups. The 128-bit digital signal processing delivers superior precision thus improving both the noise performance and the dynamic reserve. With these unprecedented capabilities, the HF2LI brings lock-in amplification to a new level and enables new applications in a frequency range that was previously tied to analog instrumentation.

The computer is connected by a high-speed USB interface, which allows to acquire data at high rates. The HF2LI is delivered with a mature graphical user interface and 3 programming interfaces that greatly add to the usability of the instrument.

Hardware

The HF2LI combines very high-end analog front-end circuits for signal sampling and high-performance digital signal processors.

High-Precision Inputs

The 2 input paths of the HF2LI are optimized for very low noise operation. The sampling rate of 210 MS/s is 4-times the analog bandwidth to ensure full capture of the signal and to avoid aliasing.

Signal Generators

The HF2LI generates 2 high-frequency outputs as a linear combination of up to 6 sinusoidals in the range from DC to 50 MHz. The amplitude, the frequency, and the phase shift can be set for each component.

Demodulators and Filters

The HF2LI provides 6 dual-phase demodulators (one for each signal generator). Each demodulator can be configured with its own filter properties including time constant from 1 µs to 500 s (corresponding to signal bandwidths from 80 µHz to 200 kHz) and filter order from 1st to 8th. The filters are implemented in advanced 128-bit digital technology. The advantages over common analog instruments are higher dynamic reserve, zero drift, accurate phase shifts, and orthogonality.

Oscilloscope and Frequency Response Sweeper

An integrated oscilloscope with memory for 2048 samples provides direct signal-vs.-time and spectral views on the input signal. Users obtain an overview of the incoming and generated signals at any time to quickly find the right settings. A frequency-response sweeper provides accurate signal-vs.-frequency plots.

Example Applications

- Solid-state and material physics
- Atomic Force Microscopy
- Semiconductor characterization and testing
- Micro and nano physics

Specifications

Table 1 - General

dimensions	45 x 28 x 9 cm (19” rack)
weight	6.2 kg
power supply	110, 120, 220, 240 V 50, 60 Hz

Table 2 - HF Signal Inputs

frequency range	0.7 µHz - 50 MHz
input impedance	50 Ω or 1 MΩ || 20 pF
input voltage noise	5 nV/√Hz
dynamic reserve	120 dB
input range	±3.5 V
input AC range	±1 mV to ±1.5 V
input full range sensitivity	1 nV to 1.5 V
A/D conversion	14 bit, 210 MS/s

Table 3 - HF Signal Outputs

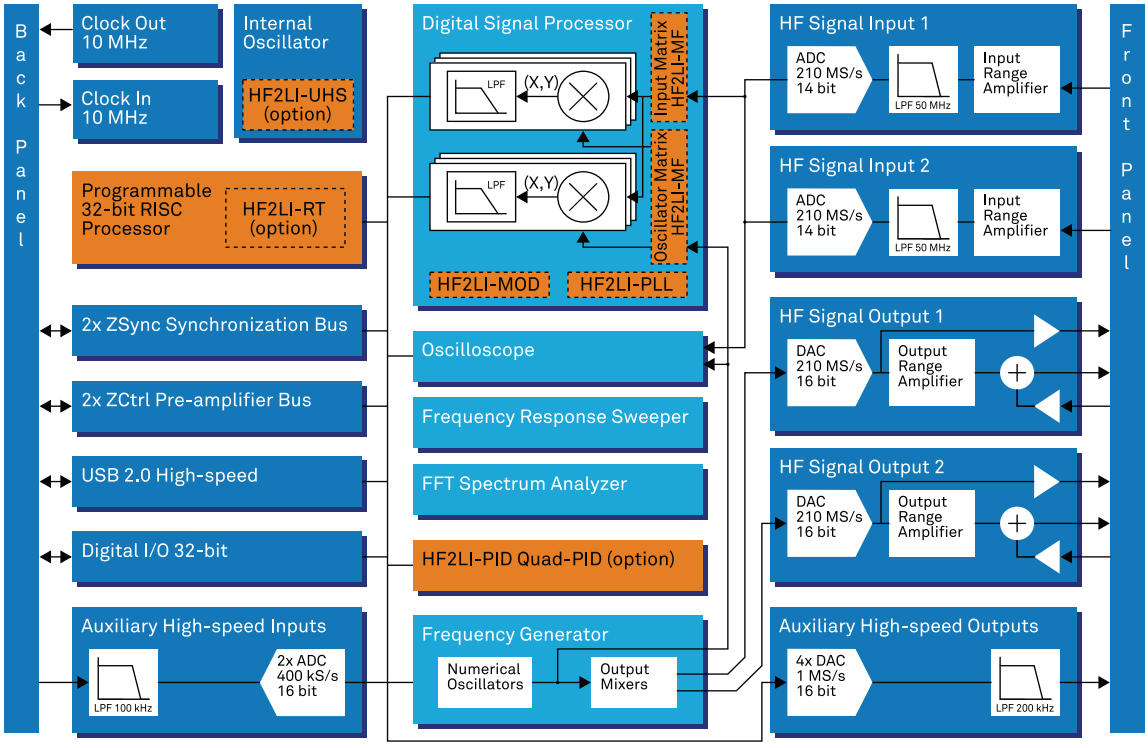
frequency range	DC - 50 MHz
output ranges	±10 mV, ±100 mV, ±1 V, ±10 V
signal adder	±10 V, DC to 50 MHz
D/A conversion	16 bit, 210 MS/s

Table 4 - Demodulators & Reference

number of demodulators	6 dual-phase
output sample rate	on USB: 100 kS/s per dem. on Aux outputs: 1 MS/s
time constant	1 µs to 500 s
measurement bandwidth	80 µHz to 200 kHz
filter slope (dB/Oct)	6, 12, 18, 24, 30, 36, 42, 48
X, Y, R, Theta samples	64-bit full range
reference frequency res.	0.7 µHz
reference phase res.	1.0 µ°

Table 5 - Auxiliary & Others

high-speed outputs	4 channels, ±10V, amplitude, phase, frequency, X/Y, value
D/A converter	16 bit, 1 MS/s
D/A analog bandwidth	200 kHz
high-speed inputs	2 channels, ±10 V
A/D converter	16 bit, 400 kS/s
A/D analog bandwidth	100 kHz
digital I/O	16 bit input, 16 bit bidirectional, 50 MHz
other interfaces	clock input, USB 2.0, 2x ZCtrl, 2x ZSync



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