GREENTEST TECHNOLOGIES

UHFQA
Quantum Analyzer

Parallel measurement of 10 superconducting or spin qubits

Product Leaflet
Release date: Nov 2018

Key Features

- 1.8 GSa/s , ±600 MHz measurement range
- Parallel readout of up to 10 qubits
- Configurable matched filters, signal conditioning, crosstalk suppression, threshold operations
- 12 bit dual-channel input
- 14-bit dual-channel AWG
- LabOne® control software (Windows and Linux) and APIs for LabVIEW®, Python, C, MATLAB®, .NET

Summary

The Zurich Instruments UHFQA Quantum Analyzer is a unique tool for parallel readout of up to 10 superconducting or spin qubits with highest speed and fidelity. The UHFQA covers a frequency span of up to ±600 MHz, with nanosecond timing resolution. It features 2 signal inputs and outputs for IQ base-band operation. Thanks to its low-latency signal processing chain of matched filters, real-time matrix operations, and state discrimination, the UHFQA supports roadmaps for ambitious quantum computing projects with 100 qubits and more.

Description

Fast Readout at High Fidelity

The UHFQA implements a pulsed measurement to determine transmission amplitude and phase of the device under test. Two methods are available to maximize the signal-to-noise ratio: pulse shaping and matched filtering. Pulse shaping with the arbitrary waveform generator minimizes the ring-up and ring-down time even for a device with slow response. The step response of the UHFQA's digital filters can be matched to the transient response of the device by programming a 4 kSa long weight function for each filter. Compared to a simple unweighted integration, applying a properly matched filter significantly improves signal-to-noise ratio.

Scalable Quantum Setup

Measuring 10 qubits on a single microwave line means optimizing the cryogenic amplification chain. A configurable 10×10 matrix signal processor allows systematic suppression of crosstalk and therefore relaxed tolerances in device fabrication. In combination with the Zurich Instruments HDAWG, several UHFQA constitute a fully synchronized instrumentation layer for qubit control and readout in the quantum stack. The low-latency 32-bit DIO interface enables feed-forward of the multi-qubit state for quantum error correction methods.

Quantum-ready Software

The UHFQA is controlled by the LabOne® software with APIs for Python, LabVIEW®, MATLAB®, and .NET. An extended example library in Python enables a straightforward integration into established measurement frameworks. Thanks to the data structuring and processing functionality provided by the LabOne Data Server, the user part of the software stack remains slim and is easy to maintain.

Specifications

General

Dimensions	45 × 35 × 10 cm (19” rack) 17.7 × 13.6 × 3.9 inch
Weight	6.4 kg
Power supply	AC: 100 – 240 V, 50/60 Hz

Signal Inputs

Frequency range	DC – 600 MHz
Input impedance	50 Ω or 1 MΩ || 18 pF
Input voltage noise	4 nV/$\sqrt{\text{Hz}}$ (> 100 kHz)
Input ranges	10 mV to 1.5 V
A/D conversion	12 bit, 1.8 GSa/s

Signal Outputs

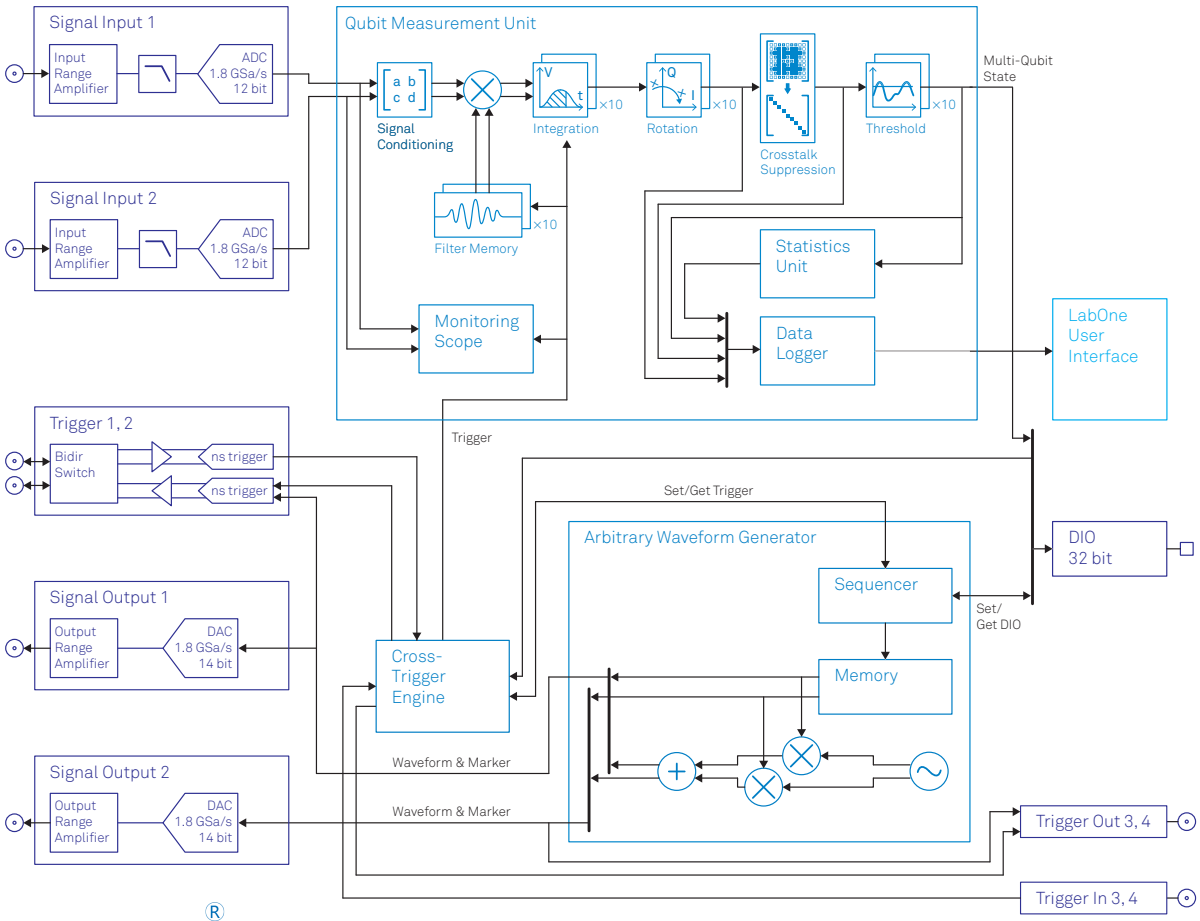
Frequency range	DC – 600 MHz
Output ranges	±150 mV, ±1.5 V into high Z
Output impedance	50 Ω, DC coupled
Phase noise	–120 dBc/Hz (10 MHz, offset 100 Hz)

Qubit Measurement Unit

Matched filters	memory 2×4 kSa/channel; 10 channels
Real-time matrix operations	1x deskew (2x2 real); 10x rotation (2x2 real); 1x crosstalk supp. (10x10 complex)
Matrix elements	range –1 to +1, res. <20e-6
Data logger	memory 1 MSa; max. 2^{17} averages
Monitoring scope	memory 4 kSa/channel; 2 channels; max. 2^{15} averages
Statistics functions	number of flips & zeros

Arbitrary Waveform Generator

Channels	2
D/A conversion	14 bit, 1.8 GSa/s
Waveform memory	128 MSa/channel (main) 32 kSa/channel (cache)
Markers	2/channel
Output modes	plain, amplitude modulation, 4-channel aux



GREENTEST TECHNOLOGIES

绿测科技有限公司

广州总部：广州市番禺区陈边村金欧大道83号江潮创意园A栋208室
深圳分公司：深圳市龙华区龙华街道 油松社区东环一路1号耀丰通工业园1-2栋2栋607
南宁分公司：广西自由贸易试验区南宁片区五象大道401号五象航洋城1号楼3519号
广州分公司：广州市南沙区凤凰大道89号中国铁建·凤凰广场B栋1201房
电话：020-2204 2442
传真：020-8067 2851
邮箱：Sales@greentest.com.cn
官网：www.greentest.com.cn

微信视频号　绿测科技订阅号　绿测工场服务号