

Zurich
Instruments

UHF-BOX Boxcar Averager

2 Input Channel,
600 MHz Boxcar Averager

Product Specification
Release date: April 2015

Key Features

- 2 boxcar units
- 600 MHz repetition rate
- Baseline suppression
- Periodic waveform analyzer
- Zero acquisition dead time
- Multi-channel boxcar
- Harmonic analyzer with 512 bars
- LabOne support for Windows and Linux

Summary

The UHF-BOX Boxcar Averager offers a powerful tool set to record, analyze and provide feedback of periodic but non-sinusoid signals with high repetition rates and low duty cycles, for instance signals derived from pulsed lasers. It operates as a high speed digitizer followed by a state of the art signal processor, and therefore it captures many more transients compared to other commercial instrumentation.

Pulsed signals contain significant higher harmonic components and a boxcar averager efficiently measures them by averaging the signal during a configurable amount of time and repeating the measurement over many periods. This twofold averaging pipeline suppresses the statistical fluctuations of the boxcar output by a factor scaling with the square root of the measurement time. With this approach, the boxcar averager considers only relevant signal parts in the time domain and captures all frequency components within the input bandwidth.

The UHF-BOX Boxcar Averager is an option for the UHFLL Lock-in Amplifier, adding a two fully-featured boxcar averager units. All features of the UHFLL are retained and therefore the user profits from a unique combination of time domain and frequency domain analysis tools.



Description

The boxcar option offers most old-school boxcar settings and functions, enhanced by the possibilities given by digital technology. Familiar specifications like gate time, gate delay and averager settings are provided and improved for much wider setting ranges.

Digital boxcar implementation practically removes acquisition dead time and therefore signals with a repetition rate up to 600 MHz can be measured. For some experiments this can decrease the measurement time by a factor of 1000 compared to old-school analog boxcar averagers.

Baseline Suppression

Each of the two boxcar units provides the capability to subtract a second averaging window of the same length from the result of the gated averaging. This allows for baseline suppression or the subtraction of reference pulses from the signal of interest.

Synchronous Detection

The UHF-BOX option can operate with both internal and external periodic triggers and can generate two frequencies for synchronization of external components. In cases where external signals determine the periodicity, state-of-the-art PLLs provide optimal reference stabilization. This provides the elimination of trigger induced jitter improving the measurement result considerably.

Periodic Waveform Analyzer

By associating every input sample with one of 1024 data bins as a function of the reference oscillator over many periods, it is possible to instantaneously display the waveform of the input signal with a high resolution. Each bin covers a fraction of the signal period and it is possible to zoom into selectable details. The PWA can also be used to set the boxcar window graphically. Moreover the FFT performed on the 1024 bins corresponds to the simultaneous measurement of 512 harmonic frequencies.

Multi-channel Boxcar

The measurement data acquired from experiments with two time bases is convoluted in the time domain. Instead of waiting for offline de-convolution, the multi-channel boxcar provides on-the-fly averaging of the boxcar outputs with a second set of PWAs.

Specifications

Old-school boxcar features

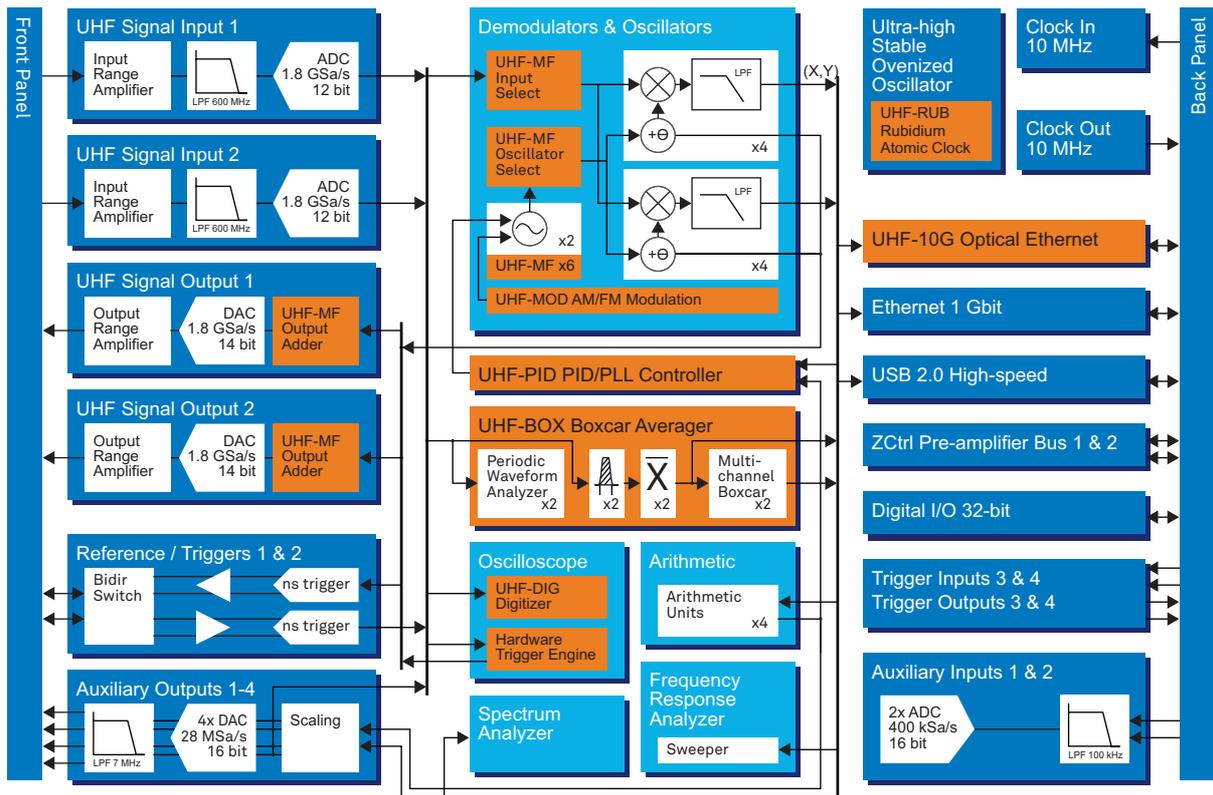
signal inputs	2 units
boxcar averagers	2 units
signal input bandwidth	600 MHz, 1.5 ns rise

Old-school boxcar features

maximum repetition rate (trigger/gate rate)	600 MHz, internal and external trigger 450 MHz with baseline sup.
acquisition dead time	0 (f < 450 MHz) 1.6 ns (f > 450 MHz)
input sensitivity range	10 mV to 1.5 V
maximum gain	1'000'000 V/Vs
input noise	4 nV/√Hz (> 100 kHz) 122 μV at full bandwidth
averaging length	1 to 1 M averaged samples
gate time range	<556 ps to 9.3 ms
boxcar output	28 MSa/s

Digital boxcar features

input sampling	12 bit, 1.8 GSa/s
data bins for periodic waveform analyzer	1024
data bins for multi-channel operation	1024
measured harmonics	512 (simultaneously)
modes of operation	baseline suppression, multi-channel, differential



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About Zurich Instruments
Zurich Instruments makes lock-in amplifiers, boxcar averagers, phase-locked loops, and impedance spectroscopes that have revolutionized instrumentation in the high-frequency (HF) and ultra-high-frequency (UHF) ranges by combining frequency-domain tools and time-domain tools within each product. This reduces the complexity of laboratory setups, removes sources of problems and provides new measurement approaches that support the progress of research.

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