DC110

250 MHz
1 GS/s

acqiris

Modular
CompactPCI/PXI
Digitizer
with Oscilloscope
Characteristics

acqiris

DC110

Main Features

- **1 GS/s Sampling Rate**
- **250 MHz Bandwidth**
  with 50 Ω and 1 MΩ Input Impedance
- **128 kpoints Acquisition Memory**
  (2 Mpoints optional)
- **Full Front-end Amplification with Internal Calibration**
- **Mezzanine Front-end**
- **Input Protection**
- **Complete Pre and Post Triggering**
- **Low Dead-Time (<500 ns) Sequential Recording with Time Stamps**

- **Built-In High Resolution TDC for Accurate Timing Measurements**
- **1 GHz Auto-Synchro-Bus (ASBus) for Trigger and Clock Distribution between Modules**
- **Single Slot, 3U CompactPCI® Standard and PXI Compliant**
- **Low Power (<15 W)**
- **AcqirisLive Software for Windows 95/98/NT**
- **"Plug & Play" Installation**
- **National Instruments LabVIEW and LabWindows/CVI Drivers**
- **Very High Data Transfer Rate to Host PC**

High Speed Waveform Recording in CPCI or PXI Chassis

Precision Waveform Acquisition - The Model DC110 Digitizer module sets new standards in PXI based data acquisition. The digitizer features fast sampling rates (up to 1 GS/s), wide bandwidth (250 MHz) and long acquisition memory (128 kpoints, optional to 2 Mpoints). The fast sampling rate and wide bandwidth are necessary for the accurate capture of high frequency signals while the deep acquisition memory allows them to be recorded over a long time period.

Long Acquisition Memory - Long memories are essential for maintaining sampling rate and therefore timing resolution when capturing complex signals. For example, a Model DC110 with 2 Mpoints of memory can record a signal over a two millisecond period with a sampling rate of 1 GS/s (1 ns per point). The fast sampling rate ensures that all high frequency signal components, up to the full 250 MHz bandwidth of the digitizer, are accurately recorded. If the memory was reduced to 20 Kpoints the sampling rate would have to fall to just 10 MS/s (20,000 points per 2 ms). Frequencies above 5 MHz would then be incorrectly digitized and important events may be missed completely!

Multi-Channel Acquisition - The DC110 is a single CompactPCI/PXI module making it ideal for use in multi-channel bench-top applications as well as in high-density rack-mounted systems. It includes Acqiris' ASBus, a proprietary high bandwidth auto-synchronous bus system. In multi-channel applications, ASBus takes care of the distribution of all necessary trigger and clock signals. The system improves trigger flexibility by allowing any module's input to be used as the trigger source for all the digitizers. ASBus can also be used to clock all the digitizers at precisely the same time. Synchronous digitizing improves the accuracy of cross-channel measurements and is essential for accurate time correlation. The ASBus can also phase-synchronize all the digitizers to an external standard (such as a 10 MHz reference).

Easy to Set Up and Use - Using a DC110 Digitizer is just like driving a familiar digital oscilloscope. Windows based software allows adjustment of the key acquisition settings such as time-base, trigger and sensitivity while state-of-the-art front-end electronics allow high fidelity recording with full control over features such as input impedance, coupling, gain and offset. Data recorded by the DC110 can be transferred directly to a host PC at rates up to 100 Mbytes/s. Combining the fast transfer rates with today's most powerful PC processors makes it possible to perform measurements and calculations hundreds of times faster than with conventional instruments.

You can also store hundreds of waveforms directly on the PC's hard disk or make hard copies instantly on your printer. Archiving important waveforms has

never been easier. Furthermore, you can interface directly to your desktop PC and use the Internet (or a local network) to send important information to others anywhere and at anytime. The result is flexibility and performance that can dramatically reduce testing times, increase measurement throughput and lower overall cost. It all adds up to make the DC110 the Digitizer of choice in Telecommunications, Magnetic Media, Automotive, Time of Flight Mass Spectroscopy, Computing, Particle Physics, Military, Explosive-Weapons and Ballistic Testing.

Scope Like Characteristics: Amplifier, Trigger and Time Base

Complete Signal Conditioning - The signal input of each DC110 Digitizer has a programmable amplifier that provides a complete set of voltage ranges (from 50 mV to 5 V full scale in a 1, 2, 5 sequence) and variable voltage offset. The inputs have selectable impedance (50 Ω or 1 MΩ) and are fully protected against over-voltage signals. The amplifiers feature internal calibration on demand (no need to disconnect input signals) and fast recovery from out-of-range signals. The input buffer is mounted on a removable mezzanine card. In the event of accidental damage, or as components fatigue over time (e.g. relays in high duty cycle automated testing applications), the mezzanine card allows for fast and efficient replacement.

Flexible Trigger - The Digitizer includes a trigger system with full pre and post trigger adjustment. User selectable coupling is combined with internal or external trigger sources for maximum flexibility. The Digitizer also provides a sophisticated sequential trigger mode with less than 500 ns dead time between successive triggers. This extremely low dead time enables events, which may occur at very high repetition rates, to be captured and stored in their correct arrival sequence. This trigger mode is perfect for "impulse-response" type applications (RADAR, SONAR, LIDAR, Time-of-Flight, Ultrasonic, Medical & Biomedical research, etc.). The sequential trigger mode and very low dead time greatly extend the digitizers timing range and resolution. Each event can be individually time stamped and relative time measurements (between events) can be made with less than 1 ns resolution.

Precision Time Base - Each Digitizer has its own crystal-controlled precision time base and sample rates can be selected, in a 1, 2, 2.5, 4, 5 sequence, from 100 S/s to 1 GS/s. An internal Trigger Time Interpolator (TTI) with high timing resolution (80 ps) is used to assist with timing calibration and trigger positioning. The TTI permits accurate positioning of the trigger point with regard to the internal clock (sampling time). The sample rate can also be generated externally; using the external input connector, for applications where the sample rate must be synchronized with the signal to be acquired.

The DC Series Digitizers use large-scale integrated circuit technology to reduce size and power requirements. This essential technology allows the DC110 to deliver the fastest sampling rate, highest bandwidth and most memory for any digitizer in a 3U CompactPCI/PXI package.

High Fidelity Measurements

Quality Acquisitions - Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, integral and differential linearity) are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom IC's and special packaging techniques are all used to reduce overall system noise. The low noise and low harmonic distortion are best demonstrated by the following Fourier Transform which is performed on an acquired signal. Other important qualities of the digitizer are demonstrated by its "low-overshoot" step response, flat frequency response and high effective bit score. The figures below depict typical measurements.
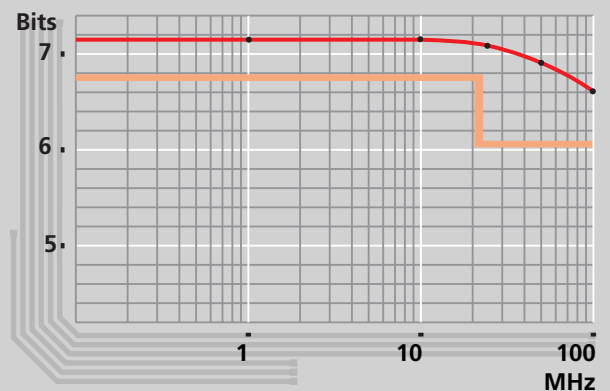
DC110
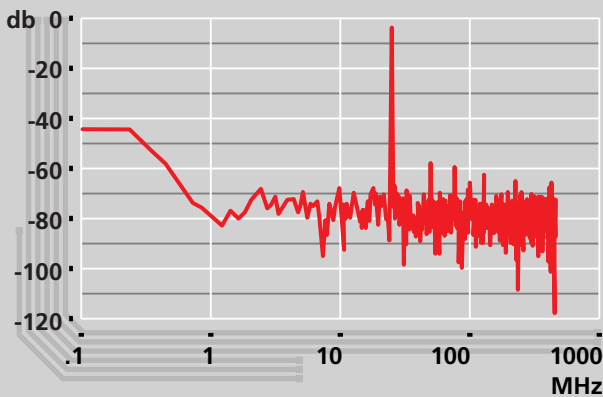
FFT analysis of a pure 25MHz sinewave, measured at 500 mV full scale, shows very low noise floor and little harmonic distortion
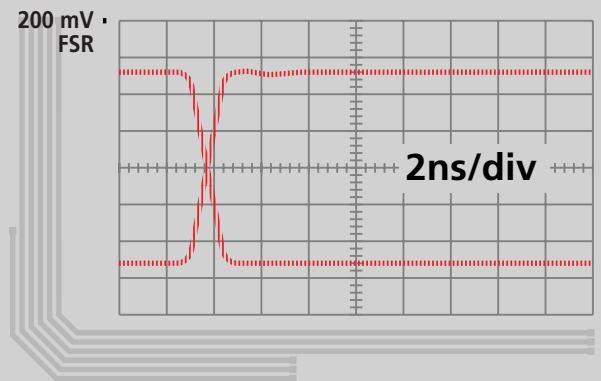
Positive and negative step responses show little or no overshoot or undershoot
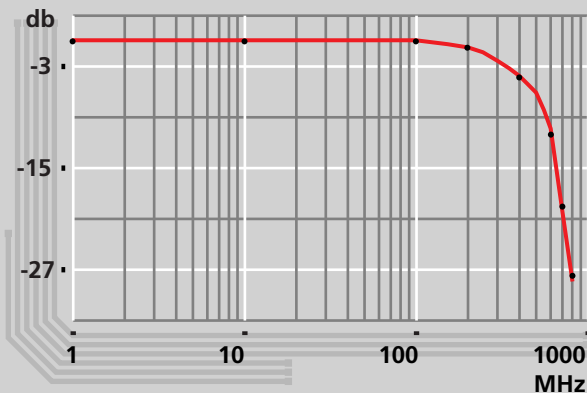
Frequency response is very flat and system bandwidth reaches well beyond the specified 250 MHz

Effective bits (top graph) are significantly higher than the minimum guaranteed performance (bottom graph)

High Reliability and Low Power Design

Low Parts Count - A very high level of integration is needed in order to achieve the level of performance obtained with the Model DC110 Digitizer. By drastically reducing the number of components the integration also has clear benefits for reliability and lowers total power consumption. To maintain quality measurements the DC110 uses a proprietary cooling scheme. This cooling method allows components to run at safe and stable operating temperatures. It helps to extend component life as well as minimizing measurement errors caused by temperature variation.

## Ease of Installation, Ease of Use and AcqirisLive

Ease of use - Installing and operating your data acquisition system is easy thanks to "Plug & Play" modularity and Windows based installation software (on CD). Just insert the CD in your PC's drive, run the installation program, and power down and install the Digitizers. Installation problems are quickly resolved using Acqiris' diagnostic tool-set and on-line help. Run AcqirisLive, a complimentary Digitizer control and waveform display software package, and start making acquisitions immediately. Now you can leverage the power of your PC to perform rapid data analysis without paying the overhead costs associated with GPIB based stand-alone test instruments.

The installation and operation of the Model DC110 is supported by the following software components:

- An automatic installation program (on CDROM) for the software components listed below

- "Plug & Play" drivers for Windows 95/98/NT4, capable of managing several digitizers simultaneously. The drivers work with Visual C++ as well as Visual BASIC.

- Drivers for National Instruments' LabVIEW and LabWindows/CVI environments

- AcqirisLive, which permits the interactive operation of digitizers 'right-out-of-the-box'. Data files can be stored in ASCII format for convenient use in spreadsheet programs such as Excel.

Getting Started - Acqiris also supplies simple application examples in source code as a starting-point for application-specific developments in C/C++ or Visual BASIC, as well as with test environment such as LabWindows/CVI and LabView. The software drivers make system integration fast and affordable. Acqiris data acquisition systems are ideal in applications (laboratory or production) where low cost and high-speed measurements are required.
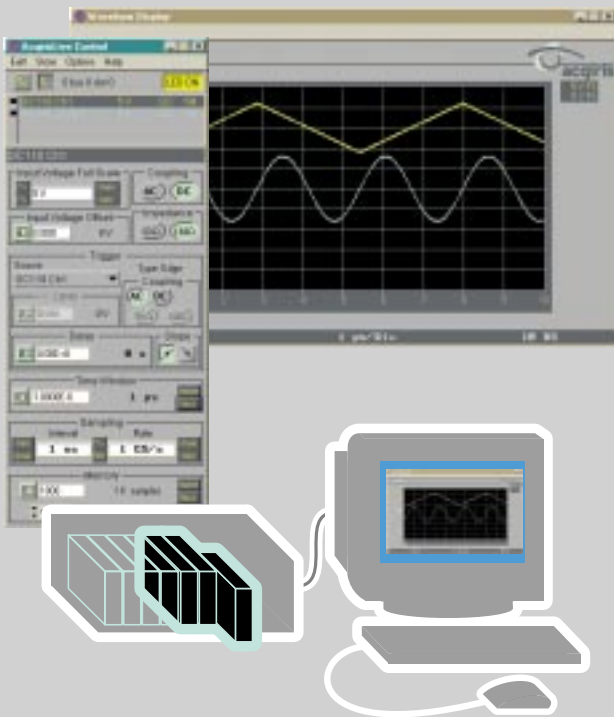
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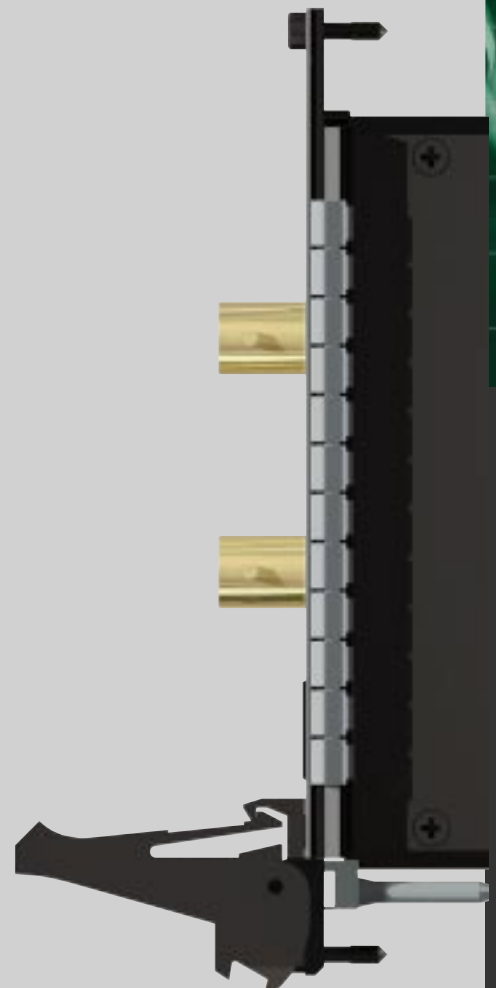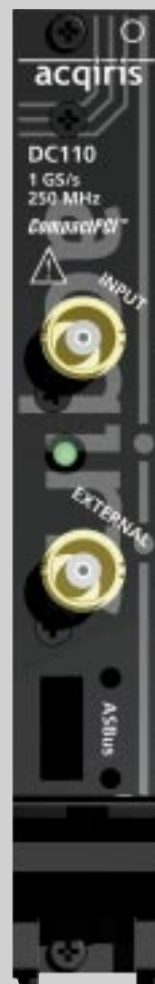
DC110 Waveform Digitizer

250 MHz, 8 bit, 1 GS/s, 128 kpoints or 2 Mpoints, Single Channel

Signal Input

Bandwidth
DC to 250 MHz (-3 dB)

Full Scale Range (FSR)
50 mV, 100 mV, 200 mV,
500 mV, 1 V, 2 V and 5 V

Impedance
1 MΩ//10 pF; 50 Ω ±1%

Connector
Gold plated BNC

Offset
±2 V at 500 mV FSR and
below, ±20 V above

Coupling
AC, DC

Maximum Input Voltage
100 V (DC + peak AC < 10 kHz)
at 1 MΩ
±5 V DC (500 mW) or 5 V RMS
at 50 Ω

Digital Conversion

Conversion Rate
100 S/s to 1 GS/s
in 1, 2, 2.5, 4, 5 sequence

Resolution
8 bits (1:256)

Aperture Uncertainty
±10 ps

Differential Linearity
±0.7 LSB

Acquisition Memories
128 kpoints or 2Mpoints (opt.)

Time Base

Range
Up to 128 us at 1 GS/s, (2 ms opt.)
Up to 1280 s at 100 S/s, (20 ks opt.)

Clock Accuracy
Better than ±25 ppm

Trigger Time Interpolator
80 ps resolution

Acquisition Modes
Single shot,
Sequence: 1 to 200 segments
(4000 optional)
Dead Time: < 500 ns

A high-speed front-panel bus (ASBus) distributes clock and trigger to synchronize multiple modules.

Trigger (Internal + External)

Slope
Positive and Negative

Coupling
AC LFReject and DC

Pre-Trigger
Adjustable to 100% of full scale

Trigger Sensitivity
From DC to 250 MHz :
Triggers on signals
> 10% FSR of channel setting
in Internal
> 500 mV in External

Post-Trigger
Adjustable up to 200 Mpoints
in 16 point increments

Connector
Gold plated BNC

External Input for Trigger, Clock & Reference

Impedance
1 MΩ or 50 Ω

Input Voltage
±4 V

Bandwidth
500 MHz (-3 dB)

External Trigger Threshold
Variable between -3 V and +3 V

External Clock Frequency
10 MHz to 500 MHz

External Clock/Ref Threshold
Variable between –2 V and +2 V

Minimum Clock/Ref Amplitude
750 mV pkpk

External Reference Frequency
10 MHz

System Performance

DC Accuracy
±2% FSR

Integral Linearity
< ±1% FSR

Effective Bits (at 1GS/s)
DC 20 MHz: > 6.8
20-100 MHz: > 6.0

PC System Requirements

Processor
150 MHz Pentium (or higher)

Operating system
Windows 95/98/NT4

Display resolution
At least 600 x 800 (for use
of AcqirisLive)

Memory
32 Mbyte RAM (more is
recommended when working
with several cards with 2M
acquisition memories)

Hard Drive Space
20 Mbyte Minimum

CD Drive

General

Power
< 15 W with 128 kpoints memory
< 17 W with 2 Mpoints memory

Current Requirements
+12 V   0.7 A
+5 V   1.1 A
+3.3 V   0.4 A (< 0.9 A with M2M)

Warranty
3 years

High-speed PCI bus transfers data at rates up to 100 Mbytes/s peak to local CompactPCI processor
Front Panel led indicates digitizer status
green: ready for trigger   yellow: module identification   red: triggered

Environmental and Physical

Operating Temperature*
0°C to 50°C

Required Airflow
>5 l/s (2 m/s)

Relative Humidity*
5% to 95% (noncondensing)

Dimensions
3U CompactPCI standard
and PXI compliant
(100 mm by 160 mm x 20 mm)

Shock*
30 G, half-sine pulse

Vibration*
5-500 Hz, random

EMC Immunity
Complies with EN50082-1

EMC Emissions
Complies with EN50081-1,
EN55022 Class B for radiated
emissions
Front panel complies with
IEEE1101.10

Certification and Compliance CE

* As defined by MIL-T-28800E Class 3

Ordering Information

Model Number	Description
DC110	Single channel, 250 MHz, 1 GS/s, 128 kpoints CompactPCI digitizer
DC110-M2M	2 Mpoints acquisition memory option
DC110-W5	5 year repair warranty
DC110-CAL	Calibration certificate
P001	300 MHz 10:1 10 MΩ passive probe

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For other sales and service representatives around the world, see our web site at:
www.acqiris.com