

# DC440

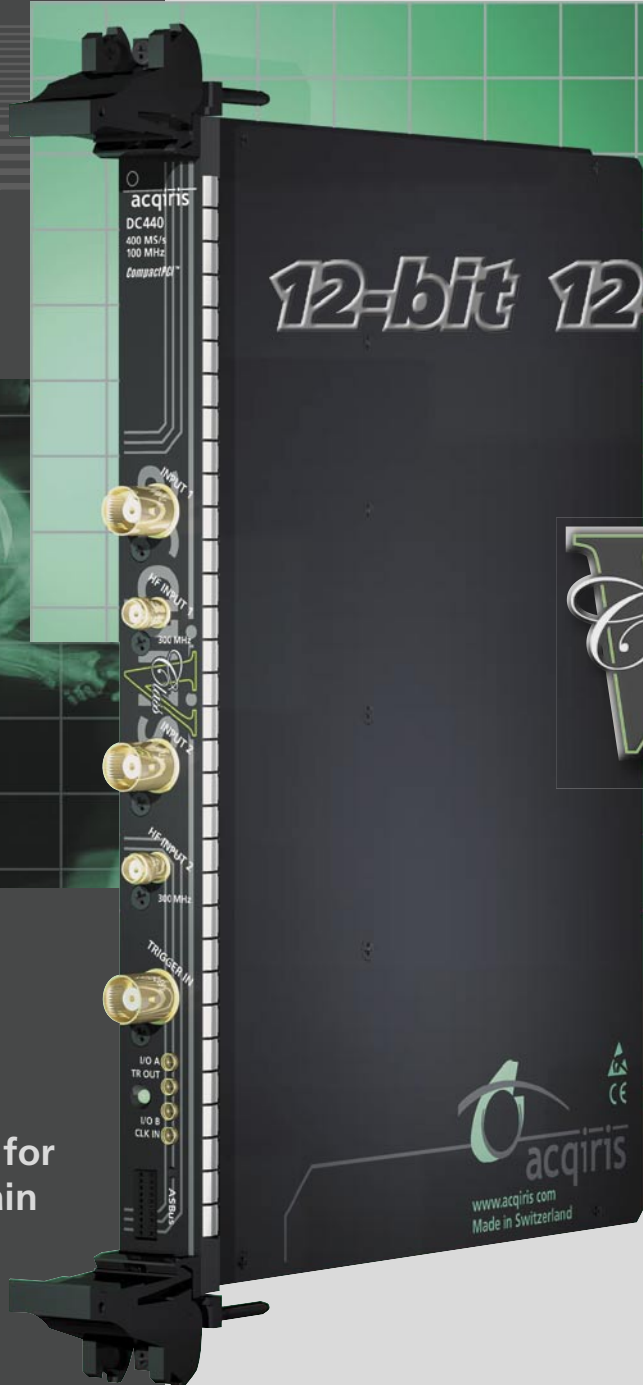
12-bit

100 MHz

400 MS/s



# acqiris



## 12-bit 12-bit 12-bit



**Performance  
with Class**

**V-Class Digitizer for  
Frequency Domain  
Applications**



**HRes SR**



**HF In**



**ASBus**  
Auto Synchro Bus



**Ctrl I/O**



## V-Class Performance with Class

The new V-Class digitizer cards from Acqiris deliver enhanced features, improved performance and absolute measurement precision.

### Main Features

- Specifically designed for wideband frequency-related measurements
- High-resolution, high-speed, dual-channel digitizer
- 12-bit monolithic ADCs, SFDR > 80 dB, SNR > 65 dB
- Up to 400 MS/s sample rate, simultaneous on two channels
- Fine-tuneable sample rate with a resolution better than 0.25% of the SR
- 100 MHz DC-coupled standard input, 300 MHz AC-coupled HF input
- 64 kpoint (4 Mpoint optional) acquisition memory per channel
- External clock/reference input for custom or high-precision frequency standard
- 50  $\Omega$  mezzanine front end with large full-scale dynamic range and input protection
- Complete pre- and post-triggering
- Low dead-time (< 1  $\mu$ s) sequential recording with time stamps
- Auto-Synchronous Bus system (ASBus) for trigger and clock signal distribution
- Modular, 6U CompactPCI® standard (PXI compliant)
- Low power consumption (< 25 W)
- Device drivers for Windows 95/98/NT4.0/2000/XP, VxWorks and Linux
- Auto-install software with application code examples for C/C++, Visual Basic, National Instruments LabVIEW and LabWindows/CVI
- "Plug & Play" installation
- High-speed PCI bus transfers data to host PC at sustained rates up to 100 MB/s

### Unique Tools for Complex Frequency Analysis

#### High-Resolution Sample Rate



##### HRes SR

The DC440 12-bit digitizer has its own crystal-controlled high-resolution precision time base. Sampling rates can be precisely tuned with a resolution better than 0.25% (500 kS/s in the 200-400 MS/s range) of the sampling frequency, in the full range between 100 S/s up to 400 MS/s. This unusual time base flexibility is ideal for wideband frequency-related measurements allowing for easy demodulation processing of I/Q modulated carriers like the ones used in QAM or RF/IF digital receivers. The High Resolution Sample Rate (HRes SR) utilization ranges from IF sampling and wireless communication (and derivative applications) to radar identification. The HRes SR can also be exploited to deliver a fine-grained adjustable distance/sample-period ratio in ranging applications.

#### High Speed and Precision



##### HF In

The Model DC440 12-bit digitizer sets new standards in CompactPCI®-based high-resolution data acquisition. The digitizer features two independent input channels with fast sample rates up to 400 MS/s, broad bandwidth of 100 or 300 MHz for extended frequency-related investigation, and long acquisition memories (64 kpoint standard, optional to 4 Mpoint for each channel). High sample rates and wide bandwidth combine to allow the high-resolution capture of signals, up to 100 MHz through standard DC-coupled BNC inputs and up to 300 MHz via high-frequency AC-coupled SMA inputs (HF In). High SFDR (> 80 dB) along with high signal-to-noise ratio (SNR > 65 dB) make the Model DC440 ideal for applications in the areas of wireless communication equipment testing, general QAM or RF/IF digital receivers and radar wideband communication and analysis (SIGINT). The high-frequency 300 MHz input is ideal for undersampling techniques.

## High-Resolution Multichannel DAQ System under PC Control

### Up to 14 Channels in One Crate

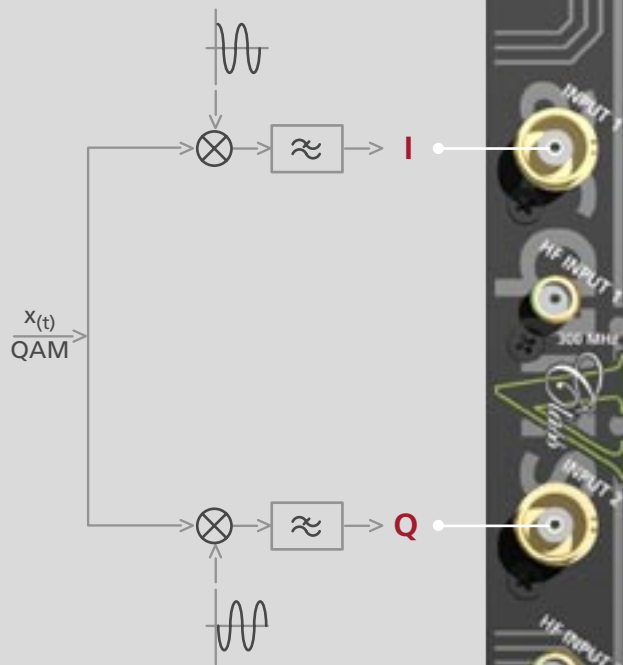


#### ASBus

The Model DC440 is a dual-channel CompactPCI® (6U) module that is ideal for use in high-resolution multichannel applications. For example, a single 8-slot 6U cPCI/PXI crate (CC108) can house up to 7 modules (plus an interface) to make a 14-channel benchtop data acquisition system. The low power consumption of the DC440 (< 25 W) results in a 14-channel system that uses less power than most comparable multichannel VXI-based systems. The Model DC440 includes Acqiris' ASBus, a proprietary high-bandwidth auto-synchronous bus system. In multichannel applications, ASBus is a vital tool designed to deliver all necessary trigger and clock signals. The system improves trigger flexibility by allowing any module input to be used as the trigger source for all the digitizers. For synchronous data acquisition, ASBus allows all the digitizers to be clocked 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 be used to phase-synchronize all the digitizers to an external standard (such as a 10 MHz reference).

### PC Control and Convenience

Using a DC440 digitizer is just like driving a familiar digital oscilloscope with the advantage of obtaining high resolution. 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 enable high-fidelity recording with full control over features such as coupling, gain and offset. Data recorded by the DC440 can be transferred directly to a host PC at rates up to 100 MB/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. The result is flexibility and performance that can dramatically reduce testing times, increase measurement throughput and lower overall cost. For high resolution in frequency-related (up to 300 MHz) multichannel applications in telecommunications, wireless communication, radar, particle physics, EW and military, the DC440 is the digitizer of choice.



*The DC Series digitizers use large-scale integrated circuit technology to reduce size and power requirements. This essential technology allows the DC440 to deliver V-Class performance for frequency analysis of any 12-bit digitizer in the standard CompactPCI form factor.*



**Performance with Class**



## Advanced Features for Broadband Signal Capturing

### Mezzanine Front End

For each channel both the standard and HF inputs are located on a separate mezzanine hosting the front-end electronics. The standard signal input of the DC440 digitizer has programmable front-end electronics that provide a complete set of input voltage ranges (from 250 mV to 10 V full scale in a 1, 2, 5 sequence) and variable voltage offsets. The HF input bypasses the input stage and gives direct access to the ADCs. Both the standard and HF inputs have 50  $\Omega$  impedance and are protected against over-voltage signals. The amplifier in the standard input features internal calibration (no need to disconnect input signals) and very fast recovery from out-of-range signals. The fact that the input buffer amplifier and ADCs are mounted on a removable mezzanine card guarantees that, in the event of accidental damage or as components fatigue over time, replacement is fast and efficient.

### Flexible Trigger

The digitizer includes a precision 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 1  $\mu$ s dead-time between successive triggers. This 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, lidar, ultrasound, medical and biomedical research, etc.). The sequential trigger mode and very low dead-time greatly extend the digitizer timing range and resolution. Each event can be individually time-stamped and relative time measurements (between events) can be made with better than 60 ps accuracy.

Further more, a TV trigger capability has been added. This opens the way to wideband video signal applications such as the ones based on fast CCD cameras for imaging readout. The TV trigger mode is for positive video modulation and allows line and frame selection (odd & even) for the common standards B/G (625 lines/50 frames, PAL), L (625 lines/50 frames, SECAM) and M (525 lines/60 frames, NTSC).

### Front-Panel Multi I/O Ports



Ctrl I/O

The control over the trigger and time base is made even more flexible by the addition of high-density, high-frequency front-panel connectors. The four MMCX-type front-panel connectors enable the use of an external clock (up to 400 MHz) or reference signal (10 MHz), a trigger output and two additional I/O digital control lines. The latter can be used for monitoring or modifying the digitizer's status and configuration; an example of the control available is trigger gating. Further more, the I/O B can be used as a 10 MHz built-in source for autonomous board test purposes.

## High Reliability

### Low Parts Count

A very high degree of integration is needed in order to achieve the level of performance obtained with the Model DC440 digitizer. By drastically reducing the number of components the integration delivers clear benefits in terms of reliability and lowers total

power consumption. To maintain quality measurements the DC440 also 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

### Acqiris Software

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 drive, run the installation program, power down and install the digitizers. Installation problems are quickly resolved using the Acqiris diagnostic tool

set and on-line help. Use the complimentary digitizer control and waveform display software package to 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 standalone test instruments.

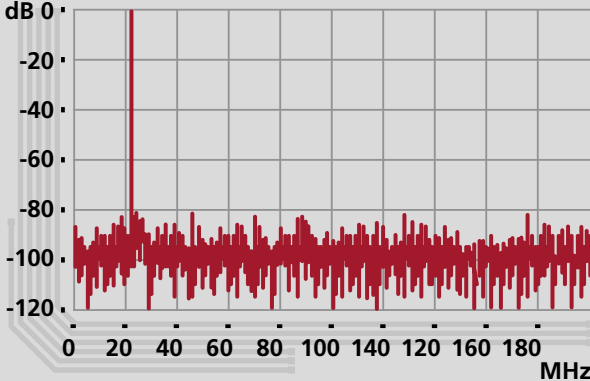
## High-Fidelity Frequency-Related Measurements

### Quality Acquisitions

Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, integral and

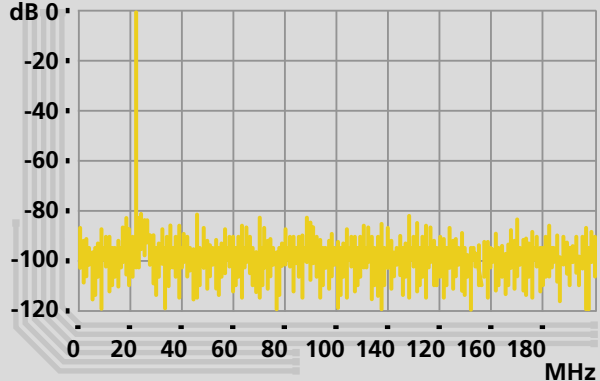
differential linearity, phase noise) are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom ICs and special packaging techniques are all used to reduce overall system noise.

### FFT Analysis: Standard Input

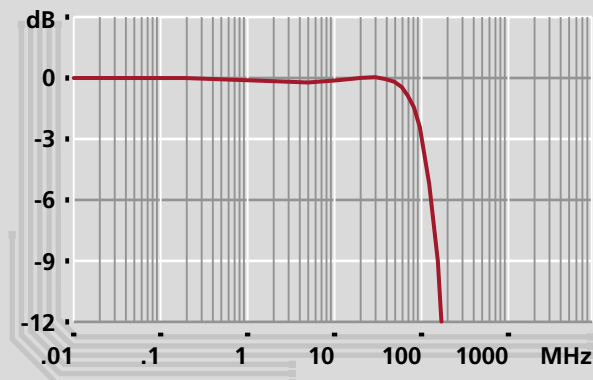


FFT analysis of a pure 25 MHz sine wave at 400 MS/s shows amazingly low noise floor, extremely high SFDR and little harmonic distortion for both the standard and high-frequency inputs.

### FFT Analysis: HF Input

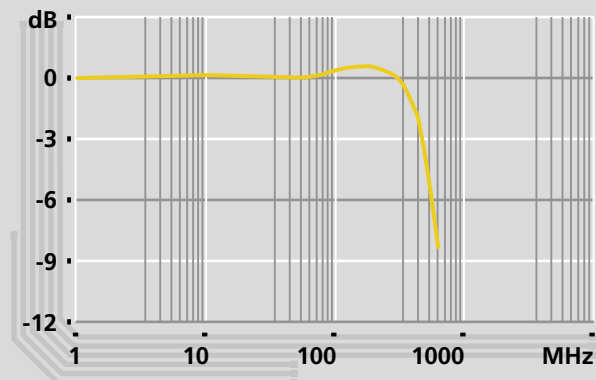


### Frequency Response: Standard Input



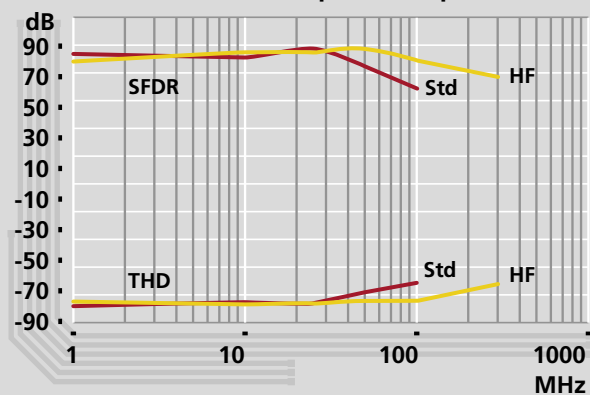
Frequency response for standard input is flat and system bandwidth for 1 V FS exceeds the specified 100 MHz.

### Frequency Response: HF Input



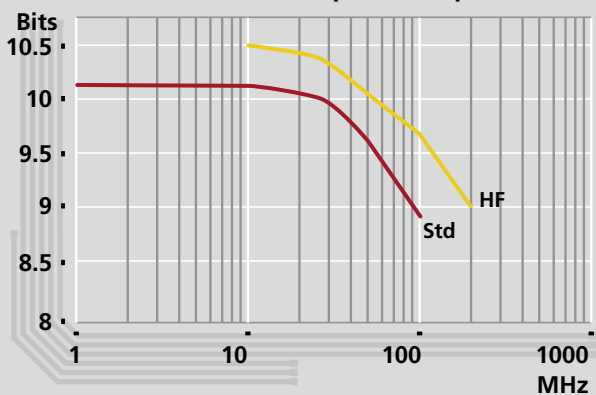
Frequency response of HF input shows system bandwidth above the specified 300 MHz.

### SFDR & THD: Standard Input, HF Input



SFDR & THD values at 170 MS/s SR and 80% of 1 V FS are remarkably high for both the standard and HF inputs.

### Effective Bits: Standard Input, HF Input



Effective bits at 170 MS/s SR and 80% of 1 V FS are well above 10 for both the standard and HF inputs.

# V-Class Digitizer for Frequency Domain Applications

## Model DC440

Dual-channel, 12-bit, 100 MHz, 400 MS/s, 64 kpoint or 4 Mpoint acquisition memory

### Standard Input – 50 Ω BNC

**Bandwidth (-3dB)**

DC to 100 MHz

**Full Scale Range (FSR)**

250 mV, 500 mV, 1 V, 2 V, 5 V and 10 V

**Impedance**

50 Ω ± 0.5% @ DC

**Connector**

BNC, gold-plated

**Offset**

±1 V for 250, 500 mV and 1 V FS

±2 V for 2 V FS

±5 V for 5 V FS

±10 V for 10 V FS

**Channels**

Two

**Coupling**

DC into 50 Ω BNC

**Maximum Input Voltage**

±10 V DC (2 W) or 10 V RMS at 50 Ω

**Bandwidth Limit Filter**

35 MHz 2-pole Bessel filter

### HF Input – 50 Ω SMA

**Bandwidth (-3 dB)**

1 to 300 MHz

**Full Scale Range (FSR)**

+8 dBm (1.75 V FS) typical

**Impedance**

50 Ω ± 5%, AC-coupled

**Connector**

SMA, gold-plated

**Channels**

Two

**Coupling**

AC

**Maximum Input Voltage**

5 V RMS (AC component) at 50 Ω

50 V DC

### Digital Conversion

**Sample Rate**

100 S/s to 400 MS/s simultaneously on both channels

**SR Adjustment Granularity**

< 0.25% of SR

500 kS/s in 200-400 MS/s range

**Resolution**

12 bits (1:4096)

**Sparkle Code Rate\***

10<sup>-12</sup> typical @ 200 MS/s

10<sup>-7</sup> typical @ 400 MS/s

\* Probability to exceed a specified deviation threshold for a sample

**Differential Nonlinearity**

±0.5 LSB

**Acquisition Memories**

64 kpoints and 4 Mpoints (optional) per channel

### Clock or Reference Input

**Connector**

MMCX, gold-plated

**Minimum Amplitude**

1 V pk-pk

**Ext. Clock Threshold**

Variable between -2 V and +2 V

**Impedance**

50 Ω

**Maximum Input Voltage**

±2 V DC

**Ext. Reference Frequency**

10 MHz ± 10%

**Ext. Clock Frequency**

From 50 MHz to 400 MHz

SR defined with sparsing

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

### Time Base

**Clock Accuracy**

Better than ±2 ppm

**Sampling Jitter**

< 1 ps RMS for 10 ms record length

**Acquisition Modes**

Single shot

Sequence: 1 to 100 segments  
(optional 4000)

Dead-time: < 1 μs

**Residual Phase Modulation**

0.3° RMS typical @ 400 MS/s

0.2° RMS typical @ 200 MS/s  
from 10 Hz to 10 MHz

### Control I/O (A & B)

**Connector**

MMCX, gold-plated

**Signals**

TTL & CMOS compatible (3.3 V)

**Input**

Trigger enable

**Output**

10 MHz reference clock (I/O B with 50 Ω output impedance, reverse terminated)

Acquisition active

Trigger ready

Acquisition skipping to next segment

## Trigger (Internal and External)

### Internal Trigger Input

Bandwidth DC to 100 MHz (-3 dB)  
Threshold adjust range: same as vertical FSR  
Trigger sensitivity DC to 100 MHz > 10% FSR  
Trigger on pk-pk signal: > 15% FS

### Pretrigger

Adjustable to 100% of horizontal full scale

### Posttrigger

Adjustable up to 100 Mpoints

### External Trigger Input

BNC, gold-plated  
Impedance: 50 Ω/1 MΩ  
Bandwidth: DC to 300 MHz (-3 dB)  
Threshold adjust range: -3/+3 V  
Maximum input voltage: ±5 V DC  
Trigger sensitivity DC to 300 MHz > 10% FSR  
Trigger on pk-pk signal: > 15% FS

### TV Trigger

Trigger for positive modulation  
Line & Frame selection (odd & even)  
Standards:  
B/G (625 lines/50 frames, PAL)  
L (625 lines/50 frames, SECAM)  
M (525 lines/60 frames, NTSC)

### Coupling

AC LFReject and DC

### Modes

Edge, positive and negative

## Trigger Output

### Output Level

Adjustable in range ±2.5 V (no load)  
Amplitude ±0.8 V (no load)  
±15 mA max.

### Connector

MMCX

### Rise/Fall Time

2.5 ns

### Coupling

DC

### Output Impedance

50 Ω

## System Performance

### DC Accuracy

< ±0.5% of FS (standard input)

### Integral Nonlinearity

< ±0.025% of FS

### SNR

> 62 dB (standard input)  
> 65 dB with BWL@ 35 MHz  
> 65 dB (HF In)

### THD (< 25 MHz signal)

< -73 dB (standard input)  
< -75 dB (HF In)

### SFDR (< 25 MHz signal)

> 75 dB (standard input)  
> 80 dB (HF In)

### Effective Bits (typ.@170 MS/s)

DC-10 MHz, BWL 35 MHz: > 10.3  
10-25 MHz, full BW: > 10  
25-100 MHz, full BW: > 8.8

## PC System Requirements

### Processor

150 MHz Pentium (or higher)

### Operating System

Windows 95/98/NT4/2000/XP  
VxWorks or Linux

### Memory

64 MB RAM (more is recommended  
when working with several cards with  
large acquisition memories)

### Hard Drive Space

20 MB minimum

### CD Drive

## General

### Power Consumption (typ.)

At 1 V FS, 400 MS/s  
< 23 W with standard memory  
< 25 W with max. memory option

### Current Requirements (max.)

12 V 0.6 A  
5 V 1.5 A  
3.3 V 1.6 A (2.2 A with max. memory option)  
-12 V 0.2 A

### Warranty

3 years

**Front-Panel LEDs** indicate digitizer status: Green: ready for trigger Yellow: module identification Red: trigger

## Environmental and Physical

### Operating Temperature

0° to 40°C

### Required Airflow

> 3 l/s (2 m/s)

### Relative Humidity\*

5 to 95% (non-condensing)

### Shock\*

30 G, half-sine pulse

### Vibration\*

5-500 Hz, random

### Safety

Complies with EN61010-1

### EMC Immunity

Complies with EN61326-1  
Industrial Environment

### EMC Emissions

Complies with EN61326-1 Class A for  
radiated emissions

### Dimensions

6U CompactPCI® standard  
233 mm x 160 mm x 20 mm

Front panel complies with IEEE1101.10

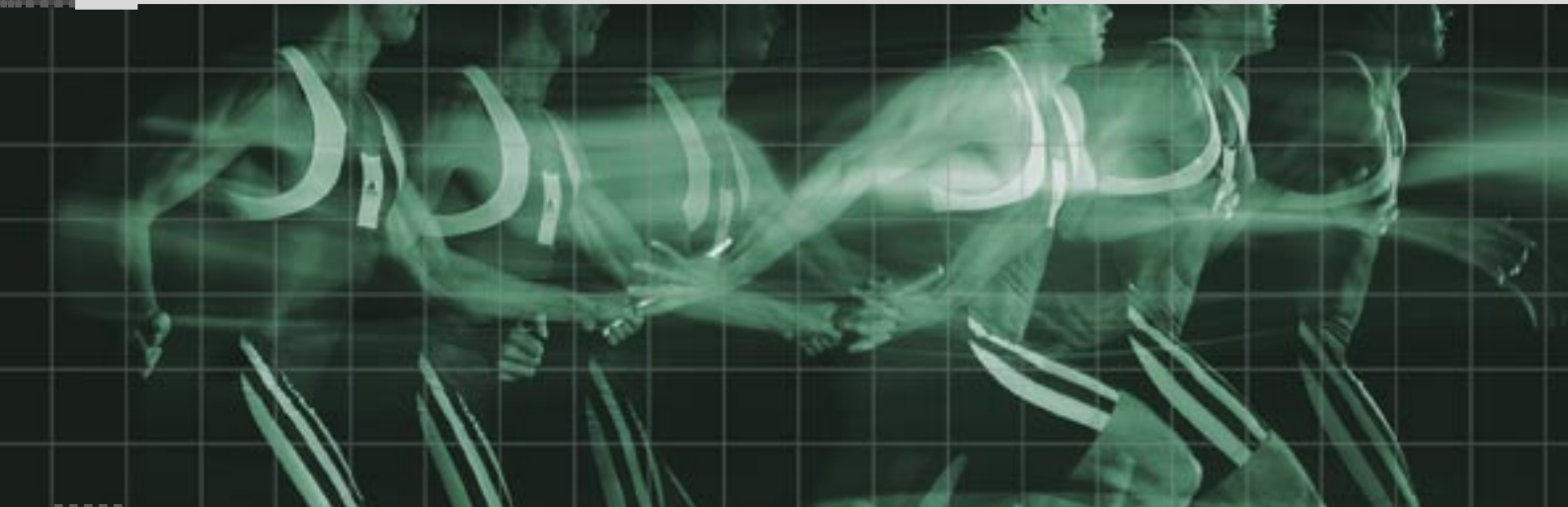
CE Certification and Compliance

\* As defined by MIL-PRF-28800F Class 3

## Ordering Information

<b>Model Number</b>	<b>Description</b>
DC440	Dual-channel, 12-bit, 100 MHz, 400 MS/s, 64 kpoint or 4 Mpoint memory CompactPCI digitizer
DC440-M4M	4 Mpoint/channel acquisition memory option
DC440-W5	5-year extended warranty
DC440-CAL	Calibration certificate
<b>Accessories</b>	
XA200	Ctrl I/O MMCX to BNC cable (1 m)

DC440



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For other sales and service representatives around the world, see our website at:

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