

Agilent U1080A Acqiris High Speed cPCI Digitizer with On-board FPGA Processing

AC240 (U1080A-001): 8-bit, 2 ch, 1 GHz, 1-2 GS/s SC240 (U1080A-002): 8-bit, 2 ch, 1 GHz, 1-2 GS/s

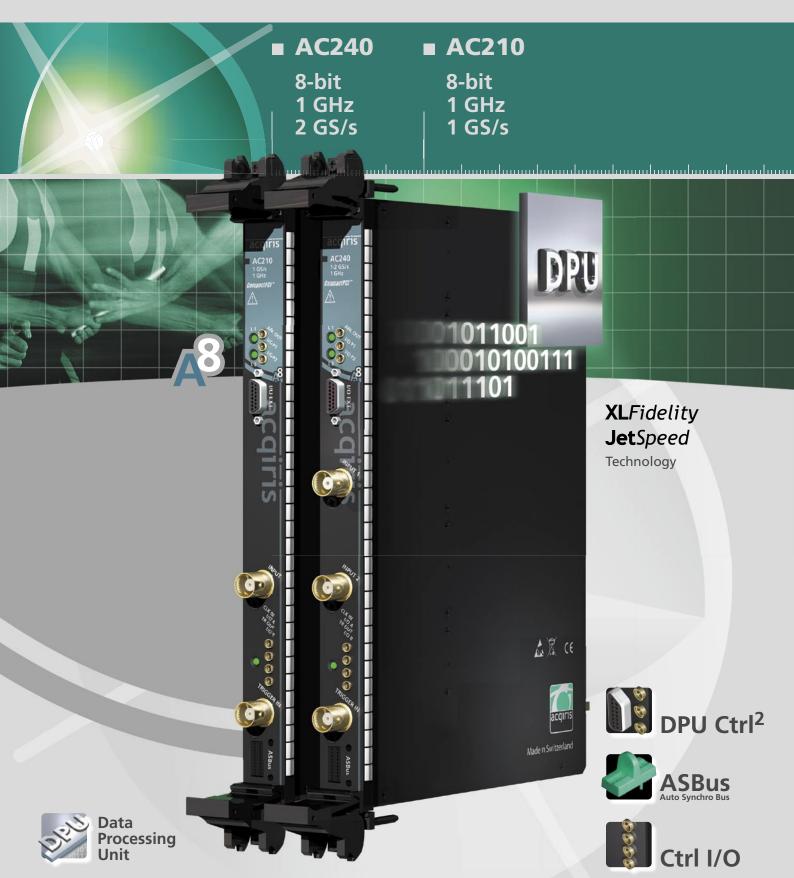
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Reconfigurable Signal Analyzer Platforms







Main Features

- On-board reconfigurable data processing unit (DPU) for real-time operations
- Front-panel digital I/O connectors for realtime data processing control (DPU Ctrl²)
- 1 GHz analog bandwidth in all FS ranges
- 1 GS/s synchronous dual-channel (AC240) and single-channel (AC210) data acquisition with independent gain and offset on each channel
- Interleaved single-channel mode (AC240) on either input, software selectable, providing up to 2 GS/s sampling rate
- Multipurpose I/O connectors for trigger, clock, reference and status control signals (Ctrl I/O)

- Optional external processing memory providing 512 MB of SDRAM and 1 MB dual-port SRAM
- Modular, 6U CompactPCI standard (PXI compliant)
- Fully-featured 50 Ω mezzanine front-end design with internal calibration and input protection
- High-speed PCI bus for data transfer to host PC at sustained rates up to 100 MB/s
- Device drivers for Windows, Wind River VxWorks and Linux
- Auto-install software with application code examples for C/C++, Visual Basic, Lab VIEW and LabWindows/CVI

Reconfigurable Platforms for Real-Time Analysis



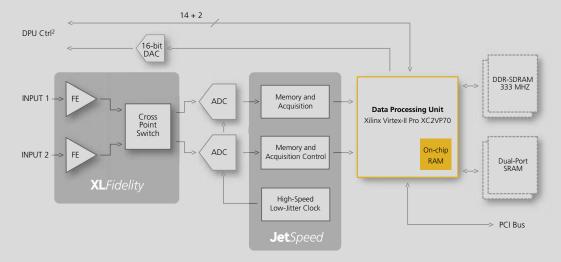
Data Processing

Reconfigurable On-the-Fly Processing

The AC240 and AC210 analyzer platforms are dual- and single-channel 6U CompactPCI®/PXITM digitizers with on-board real-time data processing. Incorporating Acgiris' proprietary

XLFidelity and **JetSpeed** ADC chipsets, the platforms are designed to cover requirements encountered in real-time applications. These analyzers are particularly suited when direct sampling techniques are used and when signals must be sampled with high rates of up to 2 GS/s and an analog bandwidth of up to 1 GHz.

Each channel provides a high-speed digitizer and a separate reconfigurable Data Processing Unit (DPU) using the latest FPGA technology, which allows the analyzer platform to be easily reconfigured to perform a variety of **user defined** on-board real-time signal processing on the digitized signal. The on-board FPGA is capable of executing multiplications in less than 5 ns and offers more than 74,000 logic cells, up to 7 Mbits of on-chip RAM, and 328 dedicated 18-bit x 18-bit multipliers with 36-bit results.





Extended Real-Time Data Processing Unit Control

DPU Ctrl² provides several front-panel DPU Ctrl² connectors for real-time control of the DPU. The function of these connectors and LEDs is user defined through the implemented firmware.

- > Two front-panel digital I/O MMCX-type connectors (I/O P1 & P2) are dedicated to the direct control of the data processing unit.
- > A third MMCX front-panel coaxial connector (ANL Out) is the output of a 16-bit on-board DAC. This analog signal can be used in simple control systems.
- > Two LEDs (L1 & L2) provide a visual reference.
- > A front-panel µDB-15 connector (I/O EXT) provides fourteen bi-directional direct lines to the DPU, used as seven differential pairs.

Dual-Channel Performance with Interleave

- > AC240 offers dual-channel synchronicity for I/Q acquisitions with up to 1 GS/s sample rate. Interleaved single-channel mode up to 2 GS/s sample rate on either input is software selectable.
- > AC210 provides a single input channel with 1 GS/s sample rate.



Ctrl I/O

Trigger Mezzanine with I/O Ports

The trigger mezzanine includes the **XLFidelity** FEA102 front-end amplifier chip. The trigger processing circuit embedded in the package includes dual comparators for window triggering mode,

on chip DACs for threshold adjustment, additional filters for LF and HF reject trigger coupling and a prescaler to allow a HF divide by 4 mode.

The trigger mezzanine provides access to the circuit via a standard 50 Ω terminated BNC connector and Ctrl I/O. These four front-panel MMCX connectors provide access for an external clock or 10 MHz reference signal, a trigger output and two additional I/O digital control lines (I/O A & B) for monitoring or modifying the digitizer's status and configuration or to extract a 10 MHz clock signal.



ASBus

Auto-Synchronous Bus System

If more than two data acquisition channels are required several analyzer platforms can be combined using Acgiris' ASBus, a proprietary high-bandwidth auto-synchronous bus system. This vital tool takes care of the

distribution of all necessary trigger and clock signals, to the **JetSpeed** COS101 clock circuit.



Processing

Reconfigurable, On-the-Fly Processing

- On-board reconfigurable Data Processing Unit (DPU Xilinx Virtex II Pro) for real-time operations.
- The DPU is easily and quickly reconfigurable using Acqiris-supplied drivers to reload firmware under program control.







Built-in Processing Memory

> 7 Mbits of on-chip RAM are available to the user for custom real-time algorithms.

External Processing Memory

> Optional external processing memory providing 512 MB of DDR-SDRAM 333 MHz and 1 MB of dual-port SRAM with a read/write throughput of up to 2 GB/s to and from the DPU.

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GHz BW Front End with 50 mV - 5 V FS

The analyzer's channel inputs feature the **XLFidelity** front-end amplifier chip, FEA102. This circuit includes a programmable gain amplifier (PGA) with on-chip filtering and trigger circuitry. It provides pre-ADC signal conditioning and amplification, essential for high performance high-speed data conversion systems.

The PGA provides four global gain settings: 1.0, 2.0, 5 and 10. The filter section, which is useful for signal noise reduction, allows 2-pole Bessel bandwidth limiting at 700 MHz and 200 MHz and a single-pole filter at 20 MHz.



High Data Throughput

The AC240/AC210 analyzer platforms can be easily integrated into any standard 6U CompactPCI or PXI chassis.

The platforms are designed to take advantage of the high-speed PCI bus connection. Processed digitized data can be transferred, in DMA mode, directly to the host PC over the bus at sustained rates of up to 100 MB/s.

Precision Time Base

The Acqiris **JetSpeed** COS101 crystal-controlled precision time base drives the data conversion on both channels and sample rates can be selected in a 1, 2, 2.5, 4 and 5 sequence, from 100 S/s to 2 GS/s (1 GS/s with the AC210).

In digitizer mode an internal Time-to-Digital Converter (TDC) allows accurate positioning (5 ps resolution) of the trigger signal with respect to the internal clock (sampling time).

The sample rate can also be generated externally, using the dedicated CLK IN connector, for applications where the sample rate must be synchronized with the device generating the signal.

Reconfigurable Signal Analyzer Platforms

Model AC240

Dual-channel, 8-bit, 1 GHz, 1-2 GS/s, CompactPCI/PXI Analyzer Platform

Model AC210

Single-channel, 8-bit, 1 GHz, 1 GS/s, CompactPCI/PXI Analyzer Platform

Signal Input

Bandwidth (-3 dB)

DC to 1 GHz, guaranteed

Bandwidth Limit Filters

700 MHz, 200 MHz and 20 MHz

Full Scale (FS)

50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V and 5 V

VSWR (typical)

< 1.25 from DC to 1 GHz

Channels

AC240: two @ 1 GS/s or one @ 2 GS/s

AC210: one @ 1 GS/s

Offset Range

±2 V from 50 to 500 mV FS ±5 V from 1 to 5 V FS Connectors

BNC, gold-plated

Coupling

DC, AC, or ground coupling

Maximum Input Voltage

±5 V DC

Impedance

 $50 \Omega \pm 1\%$ @ DC

Digital Conversion

Sample Rate

AC240: 100 S/s to 2 GS/s AC210: 100 S/s to 1 GS/s In 1, 2, 2.5, 4 and 5 sequence

Resolution

8 bits (1:256)

Differential Nonlinearity

±0.8 LSB

Integral Nonlinearity

 $< \pm 1\%$ of FS

DC Accuracy

 $< \pm 2.0\%$ of FS at 0 V offset

±1% of FS typical

Effective Bits (typical)

7.0 @ 10 MHz, 1 GS/s 6.7 @ 100 MHz, 1 GS/s

SFDR (typical)

> 55 dB @ 10 MHz > 40 dB @ 400 MHz

Clock or Reference Input

Input Amplitude

> 500 mV pk-pk into 50 Ω

Connector

MMCX, gold-plated

Ext. Clock/Ref. Threshold

Variable between -2 V and +2 V

Maximum Input Voltage

±2 V DC

Ext. Reference Frequency

[9.0, 10.2] MHz

Ext. Clock Frequency

From 10 MHz to 2 GHz

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

Time Base

Clock Accuracy

Better than ±2 ppm

Trigger Time Interpolator

5 ps resolution (digitizer mode)

Sampling Jitter

< 1 ps RMS

(for 10 µs record length)

Acquisition Modes
Digitizer

Single shot, Sequence

Analyzer

Streaming to DPU

Trigger (Internal and External, Digitizer Mode)

Internal Trigger Input

Threshold adjust range: same as vertical FSR

Sensitivity: up to full BW

for > 15% FSR pk-pk signals

External Trigger Input

BNC, gold-plated

Impedance: $50 \Omega \pm 1 \%$ Threshold adjust range:

[-FS/2, +FS/2] for FS = 0.5, 1, 2, 5 V

Maximum input voltage: ±5 V DC

Sensitivity: up to full BW for > 10% FSR

pk-pk signals

Coupling

DC

AC (50 Hz LFReject) HFReject (50 kHz)

Modes

Edge, positive and negative, Window,

HF: divide by 4

Trigger Output 1)

Output Level

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

Rise/Fall Time

Connectors

Signals

2.5 ns

Control I/O (A & B) 1)

Output

Connector

Coupling

DC

50 Ω

MMCX, gold-plated

Output Impedance

2x MMCX, gold-plated 10 MHz reference clock Acquisition skipping to next seament Trigger enable

Acquisition active

Trigger ready

Data Processing Unit and Control Signals

DPU

Xilinx Virtex-II Pro XC2VP70-6

DPU Ctrl² Signals

TTL & CMOS compatible (3.3 V) through I/O P1 & P2 (MMCX) LVDS & LVPECL (2.5 V) through I/O EXT (µDB-15)

Analog Output Signal

-5 to +5 V (settling time, 1 µs typical) through ANL Out (MMCX)

DPU Ctrl Connectors

2x MMCX, gold-plated 1x µDB-15 (additional processing I/Os)

DPU Processing Memory 2) Up to 7 Mbits on-chip RAM Optional 512 MB DDR-SDRAM 333 MHz & 1 MB dual-port SRAM

PC System Requirements

Processor

150 MHz Pentium (or higher)

Operating System

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

CD Drive

Memory

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

Hard Drive Space

20 MB minimum

Environmental and Physical

Operating Temperature

0° to 40°C

Required Airflow

> 2 m/s in situ

Relative Humidity 3)

5 to 95% (non-condensing)

EMC Immunity

Complies with EN61326-1 Industrial Environment

Dimensions

6U CompactPCI/PXI standard 233 mm x 160 mm x 20 mm

Shock 3)

30 G, half-sine pulse

Vibration 3)

5 - 500 Hz, random

Complies with EN61010-1

EMC Emissions

Complies with EN61326-1 Class A for radiated emissions

TTL & CMOS compatible (3.3 V)

¹⁾ Contact Acqiris for details on the implementation of these signals using DPU firmware.

²⁾ Available data point capacity of processing memory varies depending on data handling by the applied firmware.

Front panel complies with IEEE1101.10 3) As defined by MIL-PRF-28800F Class 3.



Streamer Analyzer Platforms







Main Features

- On-board reconfigurable Data Processing Unit (DPU) for real-time operations
- Front-Panel Optical Data Links (ODL), providing aggregate 5 Gbps (30 Gbps optional)
- Streamer Firmware for sFPDP data transfer at up to 25 Gbps, with no dead time and no loss of data
- Front-panel digital I/O connectors for realtime data processing control (DPU Ctrl²)
- 1 GHz analog bandwidth in all FS ranges
- 1 GS/s synchronous dual-channel (SC240) and single-channel (SC210) data acquisition with independent gain and offset on each channel
- Interleaved single-channel mode (SC240) on either input, software selectable, providing up to 2 GS/s sampling rate

- Multipurpose I/O connectors for trigger, clock, reference and status control signals (Ctrl I/O)
- Optional external processing memory providing 512 MB of SDRAM and 1 MB dual-port SRAM
- Modular, 6U CompactPCI standard (PXI compliant)
- Fully-featured 50 Ω mezzanine front-end design, with internal calibration and input protection
- High-speed PCI bus for data transfer to host PC at sustained rates up to 100 MB/s
- Device drivers for Windows, Wind River VxWorks and Linux
- Auto-install software with application code examples for C/C++, Visual Basic, Lab VIEW and LabWindows/CVI

High-Speed Digitizers with Maximum Data Throughput



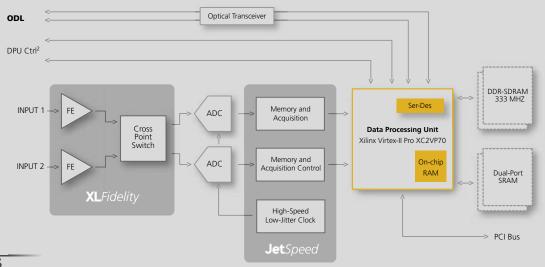
Data Processing

On-Board FPGA Processing

The SC240 and SC210 are dual- and single-channel 8-bit CompactPCI®/PXI™ digitizers with on-board real-time data processing and fast front-panel data output. Incorporating Acqiris' proprietary **XLFidelity** and **JetSpeed**

ADC chipsets, the platforms are designed to cover requirements encountered in radar or similar mass storage-related applications. The SC240 and SC210 Streamer Analyzers are particularly suited when direct sampling techniques are used and when signals must be sampled with high rates of up to

2 GS/s and an analog bandwidth of up to 1 GHz. Both models offer on-board high-performance data processing by means of a very large FPGA. Raw or processed data can be transferred through front-panel optical transceivers at rates of up to 30 Gbps. The on-board FPGA based Data Processing Unit (DPU) allows the platforms to be easily reconfigured to perform **user defined** on-board real-time signal processing on the digitized signal. The on-board FPGA is capable of executing multiplications in less than 5 ns and offers more than 74,000 logic cells, up to 7 Mbits of on-chip RAM, and 328 dedicated 18-bit x 18-bit multipliers with 36-bit results.





DPU Ctrl²

Extended Real-Time Data Processing Unit Control

DPU Ctrl² provides several front-panel connectors for real-time control of the DPU. The function of these connectors and LEDs is user defined through the implemented firmware.

- > I/O P1 and P2 are dedicated to the direct control of the data processing unit.
- > ANL Out is the output of a 16-bit on-board DAC. This analog signal can be used in simple control systems.
- > LEDs L1 and L2 provide a visual reference.
- > I/O EXT provides fourteen bi-directional direct lines to the DPU, used as seven differential pairs, through a µDB-15 connector.

Dual-Channel Performance with Interleave

- > SC240 offers dual-channel synchronicity for I/Q acquisitions with up to 1 GS/s sample rate. Interleaved single-channel mode up to 2 GS/s sample rate on either input is software selectable.
- > SC210 provides a single input channel with 1 GS/s sample rate.



Ctrl I/O

Trigger Mezzanine with I/O Ports

The trigger mezzanine includes the **XLFidelity** FEA102 front-end amplifier chip. The trigger processing circuit embedded in the package includes dual comparators for window triggering mode, on chip DACs

for threshold adjustment, additional filters for LF and HF reject trigger coupling and a prescaler to allow a HF divide by 4 mode.

The trigger mezzanine provides access to the circuit via a standard 50 Ω terminated BNC connector and Ctrl I/O. These four front-panel MMCX connectors provide access for an external clock or 10 MHz reference signal, a trigger output and two additional I/O digital control lines (I/O A & B) for monitoring or modifying the digitizer's status and configuration or to extract a 10 MHz clock signal.



ASBus

Auto-Synchronous Bus System

If more than two data acquisition channels are required several streamer analyzer platforms can be combined using Acqiris' ASBus, a proprietary high-bandwidth autosynchronous bus system. This vital tool takes

care of the distribution of all necessary trigger and clock signals to the **JetSpeed** COS101 clock circuit.



Data Processing Unit

Reconfigurable, On-the-Fly Processing

- > On-board reconfigurable Data Processing Unit (DPU Xilinx Virtex II Pro) for real-time operations.
- > The DPU is easily and quickly reconfigurable using Acqiris-supplied drivers to reload firmware under program control.

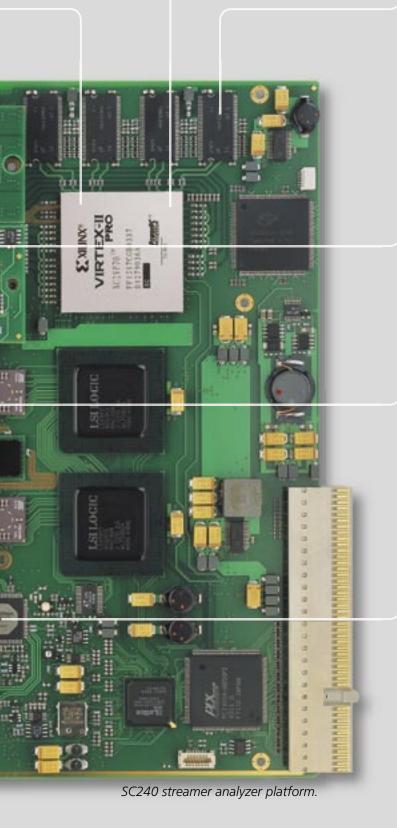






Built-In Processing Memory

> 7 Mbits of on-chip RAM are available to the user for custom real-time algorithms.



External Processing Memory

> Optional external processing memory providing 512 MB of DDR-SDRAM 333 MHz and 1 MB of dualport SRAM with a read/write throughput of up to 2 GB/s to and from the DPU.



Maximum Data Throughput

The on-board optical transceivers of the Optical Data Link (ODL) provide for data transfer through 2 or 12 (optional) optical fibers, offering up to 5 or 30 Gbps of data throughput.

Firmware included with the platform allows data streaming of acquired data using the Serial FPDP protocol. This firmware allows acquisition and transfer of all acquired data with no dead-time and no loss of data at rates of up to 2 GS/s.

Each link is connected to a Rocket I/O™ serializer-deserializer circuit present on the on-board FPGA. The ser-des circuits provide direct links between the FPGA and the optical transceiver, and allow generation of parallel data (8, 16 or 32 bits) into a serial data stream for transmission through the optical data links.

GHz BW Front End with 50 mV - 5 V FS

The analyzer's channel inputs feature the **XLFidelity** front-end amplifier chip, FEA102. This circuit includes a programmable gain amplifier (PGA) with on-chip filtering and trigger circuitry. It provides pre-ADC signal conditioning and amplification, essential for high performance high-speed data conversion systems.

The PGA provides four global gain settings: 1.0, 2.0, 5 and 10. The filter section, which is useful for signal noise reduction, allows 2-pole Bessel bandwidth limiting at 700 MHz and 200 MHz and a single-pole filter at 20 MHz.

Precision Time Base

The **JetSpeed** COS101 crystal-controlled precision time base drives the data conversion on both channels and sample rates can be selected in a 1, 2, 2.5, 4 and 5 sequence, from 100 MS/s to 2 GS/s (1 GS/s with the SC210).

In digitizer mode an internal Time-to-Digital Converter (TDC) allows accurate positioning (5 ps resolution) of the trigger signal with respect to the internal clock (sampling time).

The sample rate can also be generated externally, using the dedicated CLK IN connector, for applications where the sample rate must be synchronized with the device generating the signal.

Streamer Analyzer Platforms

Model SC240

Dual-channel, 8-bit, 1 GHz, 1-2 GS/s, CompactPCI/PXI Streamer Analyzer Platform

Model SC210

Single-channel, 8-bit, 1 GHz, 1 GS/s, CompactPCI/PXI Streamer Analyzer Platform

Signal Input

Bandwidth (-3 dB)

DC to 1 GHz, guaranteed

Bandwidth Limit Filters

700 MHz, 200 MHz and 20 MHz

Full Scale (FS)

50 mV, 100 mV, 200 mV, 500 mV,

1 V, 2 V and 5 V

VSWR (typical)

< 1.25 from DC to 1 GHz

SC240: two @ 1 GS/s or one @ 2 GS/s

SC210: one @ 1 GS/s

Offset Range

±2 V from 50 to 500 mV FS

±5 V from 1 to 5 V FS

Connectors

BNC, gold-plated

Coupling

DC, AC, or ground coupling

Maximum Input Voltage

±5 V DC

Impedance $50 \Omega \pm 1\%$ @ DC

Digital Conversion

Sample Rate

SC240: 100 S/s to 2 GS/s SC210: 100 S/s to 1 GS/s In 1, 2, 2.5, 4 and 5 sequence

Resolution

8 bits (1:256)

Differential Nonlinearity

±0.8 LSB

Integral Nonlinearity

 $< \pm 1\%$ of FS

DC Accuracy

< ±2.0% of FS at 0 V offset

±1% of FS typical

Effective Bits (typical)

7.0 @ 10 MHz, 1 GS/s 6.7 @ 100 MHz, 1 GS/s

SFDR (typical)

> 55 dB @ 10 MHz > 40 dB @ 400 MHz

Clock or Reference Input

Input Amplitude

> 500 mV pk-pk into 50 Ω

Connector

MMCX, gold-plated

Ext. Clock/Ref. Threshold

Variable between -2 V and +2 V

Maximum Input Voltage ±2 V DC

Ext. Reference Frequency

[9.0, 10.2] MHz

Ext. Clock Frequency

From 10 MHz to 2 GHz

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

Time Base

Clock Accuracy

Better than ±2 ppm

Trigger Time Interpolator

5 ps resolution (digitizer mode)

Sampling Jitter

< 1 ps RMS (for 10 µs record length) **Acquisition Modes**

Digitizer

Single shot, Sequence

Analyzer

Streaming to DPU

Trigger (Internal and External, Digitizer Mode)

Internal Trigger Input

Threshold adjust range: same as vertical FSR

Sensitivity: up to full BW for > 15% FSR pk-pk signals **External Trigger Input**

BNC, gold-plated Impedance: 50 Ω ±1 % Threshold adjust range:

[-FS/2, +FS/2] for FS = 0.5, 1, 2, 5 V

Maximum input voltage: ±5 V DC Sensitivity: up to full BW for > 10% FSR

pk-pk signals

Coupling

AC (50 Hz LFReject) HFReject (50 kHz)

Edge, positive and negative, Window, HF: divide by 4

Trigger Output 1)

Output Level

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

Rise/Fall Time

2.5 ns

Connector MMCX, gold-plated Coupling

DC

Output Impedance

50 Ω

Optical Data Links

Standard ODL

Transceiver: 2 x Small Form Pluggable

Multimode 850 nm Connector: LC™ Duplex Throughput: up to 2.5 Gbps/link Aggregate: up to 5 Gbps

High Rate ODL

Transceiver: PAROLI® 2, 1x Tx and 1x Rx,

Multimode 850 nm Connector: MPOF-12

Throughput: up to 2.5 Gbps/link Aggregate: up to 30 Gbps

Control I/O (A & B) 1)

Connectors

2x MMCX, gold-plated

Input

Trigger enable

Signals

TTL & CMOS compatible (3.3 V)

Output

10 MHz reference clock Acquisition skipping to next segment Acquisition active

Acquisition active Trigger ready

Data Processing Unit and Control Signals

DPU

Xilinx Virtex-II Pro XC2VP70-6

DPU Ctrl² Signals

TTL & CMOS compatible (3.3 V) through I/O P1 & P2 (MMCX) LVDS & LVPECL (2.5 V) through I/O EXT (µDB-15)

Analog Output Signal

-5 to +5 V (settling time, 1 μ s typical) through ANL Out (MMCX)

DPU Ctrl Connectors

2x MMCX, gold-plated 1x μDB-15 (additional processing I/Os)

DPU Processing Memory 2)

Up to 7 Mbits on-chip RAM Optional 512 MB DDR-SDRAM 333 MHz & 1 MB dual-port SRAM

PC System Requirements

Processor

150 MHz Pentium (or higher)

Operating System

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

CD Drive

Memory

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

Hard Drive Space

20 MB minimum

Environmental and Physical

Operating Temperature

0° to 40°C

Required Airflow

> 2 m/s in situ

Relative Humidity 3)

5 to 95% (non-condensing)

EMC Immunity

Complies with EN61326-1 Industrial Environment

Dimensions

6U CompactPCI/PXI standard 233 mm x 160 mm x 20 mm

Shock 3)

30 G, half-sine pulse

Vibration 3)

5 - 500 Hz, random

Safety

Complies with EN61010-1

EMC Emissions

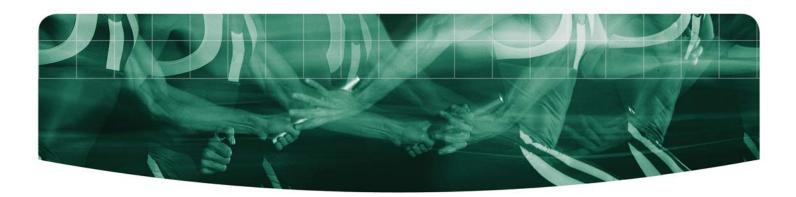
Complies with EN61326-1 Class A for radiated emissions

Front panel complies with IEEE1101.10

¹⁾ Contact Acqiris for details on the implementation of these signals using DPU firmware.

²⁾ Available data point capacity of processing memory varies depending on data handling by the applied firmware.

³⁾ As defined by MIL-PRF-28800F Class 3.



Contacts

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