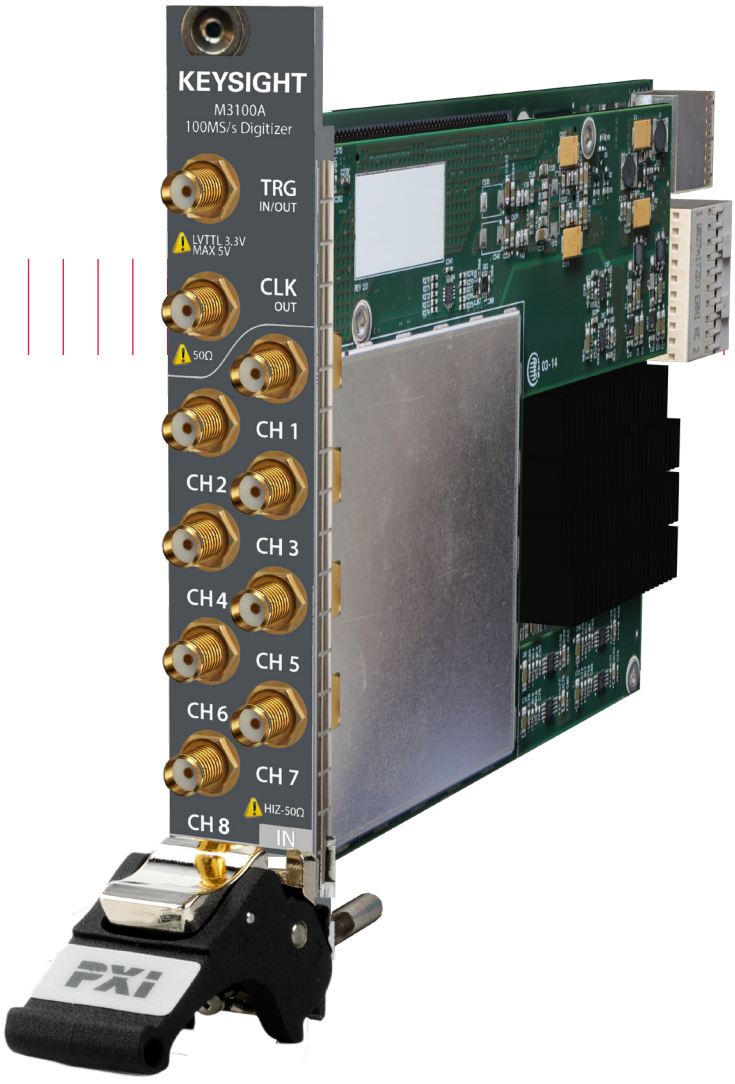
Keysight M3100A

PXIe Digitizers with Optional Real-Time Sequencing and FPGA Programming

100 MSa/s, 14 Bits, 4/8 Channels

Data Sheet



KEYSIGHT TECHNOLOGIES

Improve Your Measurement Fidelity, Signal Integrity and Measurement Throughput

The M3102A are high-performance, high-bandwidth digitizers with an advanced data acquisition system (DAQ). Performance meets simplicity thanks to easy-to-use programming libraries, real-time sequencing technology (HVI Hard Virtual Instrumentation), and graphical FPGA programming technology.

Features

100 MSa/s simultaneous sampling, 14 bits, 4/8 channels, 100 MHz BW [1]

Advanced data acquisition system (DAQ)

- Flexible triggering (HW trigger, HVI trigger, SW trigger)
- Programmable cycles and data bursts to avoid PC saturation

Optional HW programming for high-performance applications

- Real-time sequencing (HVI technology)
- FPGA programming
  - Xilinx Kintex-7, 325T or 410T FPGA

Up to 2 GB of onboard RAM (~ 1 Gsamples)

Mechanical/interface

- 1 slot 3U (PXIe)
- Up to 1.6 GB/s transfer BW with P2P capabilities (PCIe Gen 2)
- Independent DMA channels for fast and efficient data transfer

Applications

General purpose digitizer

Hardware-in-the-loop (HIL)/automated test equipment (ATE)

R&D/scientific research equipment

Aerospace & defense (A/D)

1. 100 MHz refer to the Front End bandwidth. This digitizer can operate in 1st and 2nd Nyquist zones (using undersampling technique), but its real-time BW is limited by Nyquist to some 50 MHz. As an example for a band-limited signal of 70 MHz with a 10 MHz signal bandwidth the aliased component will appear between 25 to 35 MHz (30 ± 5 MHz).

Programming Technology and Software Tools

Software programming

- Easy-to-use native programming libraries for most common languages: C, C++, Visual Studio, LabVIEW, MATLAB, Python, and more

Hardware programming (optional)

- Real-time sequencing (Hard Virtual Instrumentation or HVI technology)
  - Graphical flowchart-style M3601A design environment (-HV1 option required on HW)
  - Ultra-fast, fully-parallelized hard real-time execution
  - Ultra-fast, time-deterministic decision-making
  - Off-the-shelf inter-module synchronization & data exchange
- FPGA programming
  - Graphical M3602A FPGA design environment (-FP1 option required on HW)
  - No FPGA know-how required
  - Include high-level to low-level design elements: off-the-shelf DSP blocks, MATLAB/ Simulink designs, Xilinx CORE Generator IP cores, Xilinx VIVADO/ISE projects, VHDL or Verilog code
  - Ultra-fast, one-click compiling and on-the-fly programming

No programming

- Ready-to-use SD1 SPF (software front panels)

PXIe Arbitrary Waveform Generators, Digitizers and Combination Modules

Product	Type	Outputs (AWGs)				Inputs (Digitizers)			
		Speed (MSa/s)	Bits	Ch	BW (MHz)	Speed (MSa/s)	Bits	Ch	BW (MHz)
M3202A	AWG	1000	14	2/4	DC-400				
M3201A	AWG	500	16	2/4	DC-200				
M3102A	Digitizer					500	14	2/4	DC-200
M3100A	Digitizer					100	14	4/8	DC-100
M3302A	Combo	500	16	2	DC-200	500	14	2	DC-200
M3300A	Combo	500	16	2/4	DC-200	100	14	4/8	DC-100

Functional Block Diagram

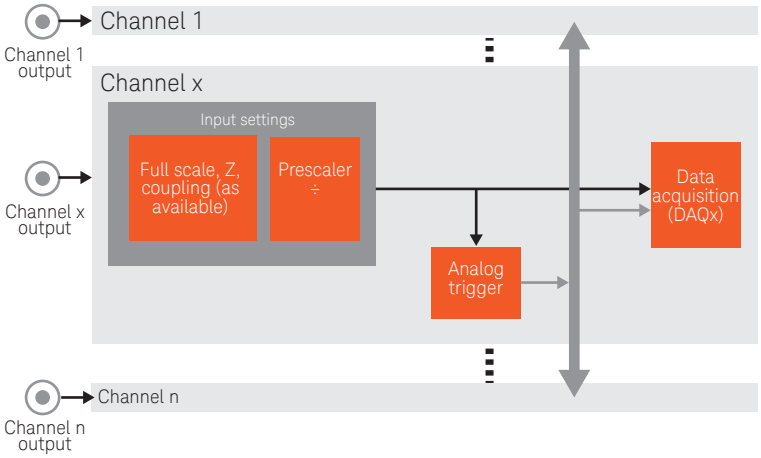


Figure 1. M3100A input functional block diagram, all channels have identical input structure

Ordering Information [1]

Product	Description
M3100A	PXIe digitizer: 100 MSa/s, 14 Bits
Options	**Description**
M3100A-CH4 / -CH8	Four channels [2] / eight channels
M3100A-CLF	Fixed sampling clock, low jitter [2]
M3100A-M01 / -M12 / -M20	Memory 16 MB, 8 MSamples [2] / 128 MB, 60 MSamples / 2 GB, 1 GSamples
HW programming options	**Description**
M3100A-HVI	Enabled HVI programming, requires an HVI design environment license (M3601A)
M3100A-FP1	Enabled FPGA programming, requires -K32 or -K41 option and an FPGA design environment license (M3602A)
M3100A-K32 / -K41	FPGA, Xilinx 7K325T / 7K410T, required for -FP1 option only (needs memory option -M20)

Related software	Description
M3601A	HVI design environment
M3602A	FPGA design environment

1. All options must be selected at time of purchase and are not upgradable
2. These options represent the standard configuration

Technical Specifications and Characteristics

General characteristics

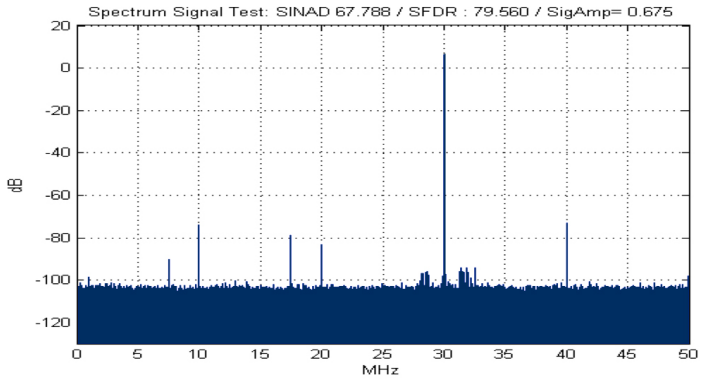
Parameter	M3100A-CH4 Min	M3100A-CH4 Typ	M3100A-CH4 Max	M3100A-CH8 Min	M3100A-CH8 Typ	M3100A-CH8 Max	Units	Comments
Inputs and outputs								
Channels		4			8		Out	
Reference clock [1]		1			1		Out	
Reference clock [2]		1			1		In	
Triggers/markers [1, 3]		1			1		In/out	Reconfigurable
Triggers/markers [2, 3]		8			8		In/out	Reconfigurable
Input channels overview								
Sampling rate		100			100		MSa/s	
Voltage resolution		14			14		Bits	
Input frequency	DC		100	DC		100	MHz	
Real-time BW		50			50		MHz	
Time skew		<50			<50		ps	Between channels
Built-in functionalities								
Input conditioning blocks		4			8			1 per channel
Analog trigger processors		4			8			1 per channel
Data acquisition blocks		4			8			1 per channel
Onboard memory								
RAM memory	16		2048	16		2048	MBytes	

1. At front panel
2. At backplane
3. Markers available from firmware version v3.0 or later

I/O specifications

Analog input characteristics	
Number of channels	CH4 or CH8
Sampling rate	100 MSa/s option CLF
Configurable inputs: impedance	50Ω or 1 MΩ (HiZ)
Configurable inputs: Coupling	AC or DC
Input voltage range (50Ω)	400 mVpp to 6Vpp (continue: variable attenuator at input)
Input voltage range (HiZ)	200 mVpp to 20Vpp (continue: variable attenuator at input)
Bandwidth limit filters	100 MHz
Effective number of bits (ENOB)[1]	10.8 bits @30MHz (typical)
Noise floor	–142 dBm/Hz @30 MHz (typical)
SINAD	67 dB @30 MHz (typical)
Spurious free dynamic range (SFDR) + Total Harmonic Distorsion	79 dBc (typical)

1. measured at -1 DBFS input signal with 1.5 Vpp 50Ω



	M3100A				
Parameter	**Min**	**Typ**	**Max**	**Units**	**Comments**
Reference clock output					
Frequency		10 or 100		MHz	Generated from the internal clock. User selectable
Voltage		800		mVpp	On a 50 Ω load
Power		2		dBm	On a 50 Ω load
Source impedance		50		Ω	AC coupled
External I/O trigger/marker					
V_{IH}	2		5	V	
V_{IL}	0		0.8	V	
V_{OH}	2.4		3.3	V	On a high Z load
V_{OL}	0		0.5	V	On a high Z load
Input impedance		10		K Ω	
Source impedance		TTL		–	
Speed			500	Mbps	

Data acquisition blocks (DAQs) specifications

Parameter	M3100A-CH4 Min	M3100A-CH4 Typ	M3100A-CH4 Max	M3100A-CH8 Min	M3100A-CH8 Typ	M3100A-CH8 Max	Units	Comments
General specifications								
DAQs		4			8			1 per channel
Aggregated speed			400			800	MSa/s	For all onboard DAQs combined
Acquisition burst multiple		5			5		Samples	Burst length must be a multiple of this value
Acquisition RAM capacity	15		957M	15		957M	Samples	Maximum depends on onboard RAM
Acquisition RAM capacity effic.		93.5			93.5		%	Effic. = waveform size / waveform size in RAM
Trigger		Selec.			Selec.			Hardware trigger (analog channels, input trigger, backplane triggers), software trigger
DAQ specifications								
Speed			100			100	MSa/s	Per DAQ
Resolution		14			14		Bits	

Clock system specifications

Parameter	M3100A-CH4 Min	M3100A-CH4 Typ	M3100A-CH4 Max	M3100A-CH8 Min	M3100A-CH8 Typ	M3100A-CH8 Max	Units	Comments
General specifications								
Clock frequency		100			100		MHz	

System Specifications

Environmental specifications (PXI Express)

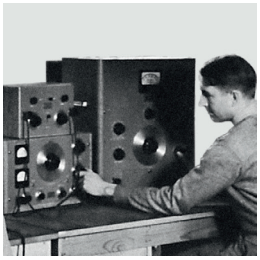
Parameter	M3100A-CH4 Min	M3100A-CH4 Typ	M3100A-CH4 Max	M3100A-CH8 Min	M3100A-CH8 Typ	M3100A-CH8 Max	Units	Comments
System bus								
Slots		1			1		Slot	PXI Express (CompactPCI Express compatible)
PCI Express type	Gen 1		Gen 2	Gen 1		Gen 2	–	Automatic gen negotiation, chassis dependent
PCI Express link	1		4	1		4	Lanes	Automatic lane negotiation, chassis dependent
PCI Express speed	400		1600	400		1600	MBytes/s	Depends on # of lanes, chassis, congestion, and more
Sustainable throughput	200		800	200		800	MPoints/s	Depends on # of lanes, chassis, congestion, and more
Power dissipation								
3.3V PXIe power supply		1.5			1.5		A	~ 5 W
12V PXIe power supply		2			2		A	~ 24 W

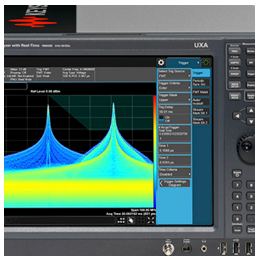
Environmental [1]		
Temperature range	Operating Non-operating	0 to +55°C (10,000 feet) -40 to +70 °C (up to 15,000 feet)
Max operative altitude		2000 m (10,000 feet)
Operating Humidity range (%RH)		10 to 95% at 40 °C
Non-operating Humidity range (%RH): 5 to 95		5 to 95%
Calibration interval		1 year
EMC		Complies with European EMC Directive – IEC/EN 61326-1 – CISPR Pub 11 Group 1, class A This ISM device is in compliance with Canadian ICES-001 Cet appareil ISM est conforme à la norme NMB-001 du Canada. This ISM device is in compliance with Australian and New Zealand RCM This ISM device is in compliance with South Korea EMC KCC

1. Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

Evolving Since 1939

Our unique combination of hardware, software, services, and people can help you reach your next breakthrough. We are unlocking the future of technology.
From Hewlett-Packard to Agilent to Keysight.





myKeysight

myKeysight
www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

http://www.keysight.com/find/emt_product_registration
Register your products to get up-to-date product information and find warranty information.

PXI

www.pxisa.org
PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

KEYSIGHT SERVICES
Accelerate Technology Adoption.
Lower costs.

Keysight Services
www.keysight.com/find/service
Keysight Services can help from acquisition to renewal across your instrument's lifecycle. Our comprehensive service offerings—one-stop calibration, repair, asset management, technology refresh, consulting, training and more—helps you improve product quality and lower costs.

CALIBRATION WARRANTY UP TO 10 YEARS
ASSURANCE PLANS

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/m3100a

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-9-7-17)

DEKRA Certified
ISO9001 Quality Management System

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2015
Quality Management System

This information is subject to change without notice.
© Keysight Technologies, 2017 - 2018
Published in USA, February 20, 2018
5992-1806EN
www.keysight.com

KEYSIGHT TECHNOLOGIES