Agilent U2300A Series USB Modular Multifunction Data Acquisition(DAQ) Devices

Data Sheet

Features

- **Up to 3 MSa/s sampling rate for a single channel**
- **Functions as a standalone or modular unit**
- **Easy to use – plug-and-play and hot-swappable with Hi-Speed USB 2.0**
- **Up to 384 channels when incorporated into U2781A Agilent modular instrument chassis**
- **Easy-to-use bundled software for quick setup and data logging to PC**
- **12-bit or 16-bit A/D resolution**
- **24-bit programmable digital input/output**
- **Self-calibration capability**
- **Compatible with a wide range of Application Development Environments**
- **USBTMC 488.2 standards**

Introduction

Agilent U2300A Series USB modular multifunction data acquisition (DAQ) devices are a high performance PC data acquisition solution. The U2300A Series DAQ devices consist of two families: basic multifunction DAQ and high density multifunction DAQ. The basic multifunction DAQ family comes in four models while the high density multifunction DAQ family is made up of three models.

The U2300A Series DAQ devices applications extend across industrial and education environments. The DAQ device is well suited for R&D, manufacturing and design validation engineers, who require measurement devices with fast sampling rate.

High sampling rate

The U2300A Series DAQ devices have a sampling rate of up to 3 MSa/s for a single channel. When multiple channels are configured, it can sample data up to 1 MSa/s. This fast sampling capability allows users to perform intermittent detection easily. This also makes it ideal when dealing with high density analog input/output signals, especially with different input ranges and sampling requirements.

Flexible standalone or modular capability

The U2300A Series DAQ devices are uniquely designed for the flexibility of functioning as a standalone or modular unit. When used with the U2781A modular instrument chassis, the number of channels can reach up to 384 channels.

Ease of use

The U2300A Series DAQ devices are equipped with Hi-Speed USB 2.0 interface for easy setup, and plug-and-play and hot swappable connectivity. Its ease-of-use makes it ideal for the education environment. Simplifying this further is the Agilent Measurement Manager software that offers a simple interface for quick setup, configuration and measurement control.

Flexible system and control

Polling and continuous mode - The U2300A Series DAQ devices provide two modes, the polling mode and the continuous mode. The continuous mode has the ability to acquire data continuously once the trigger signal is received.

Trigger sources - None (intermediate trigger), analog/external digital trigger, SSI/star trigger and master/slave trigger sources. All these trigger options give you the capability to configure trigger sources during A/D and D/A operations. Master/slave trigger and SSI/star trigger are recommended when USB modules are slotted into the Agilent U2781A USB modular instrument chassis.

Predefined function generator - Sine, square, triangle, sawtooth and noise waveforms.

Burst mode - This is incorporated to simulate simultaneous analog input.

Compatible with a range of Application Development Environments

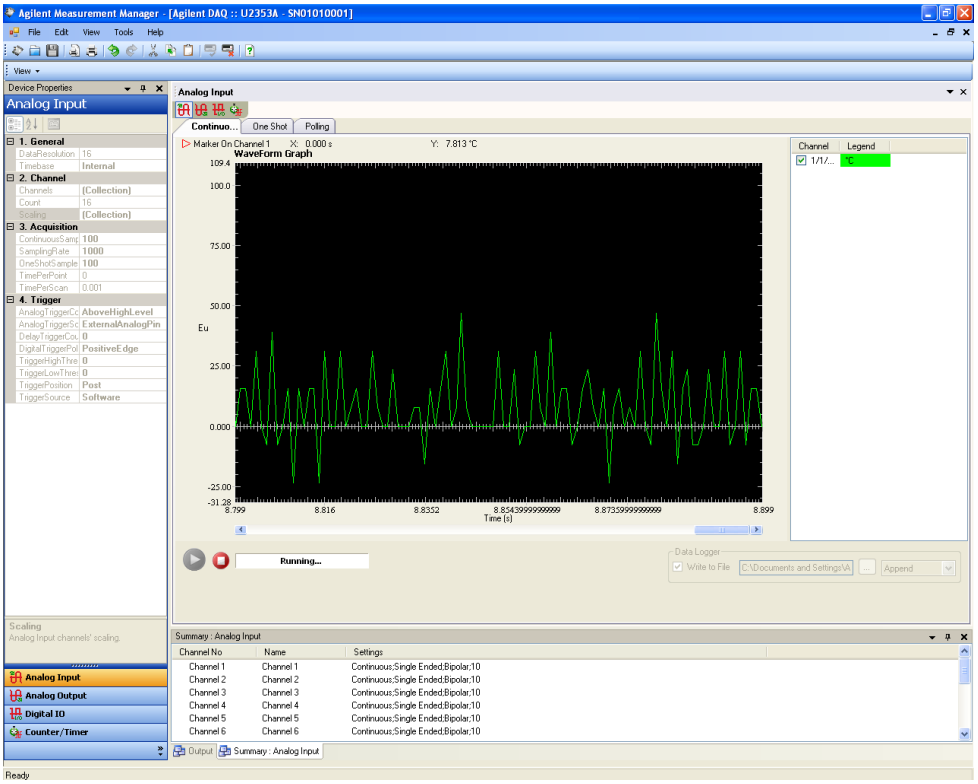
The Agilent U2300A DAQ devices are compatible with a wide range of Application Development Environments. This minimizes all the time taken by R&D and manufacturing engineers to use the devices in different software environments as they can program directly using SCPI commands.

Listed below are the popular development environments and tools that the DAQ device is compatible with:

- Agilent VEE and Agilent T&M Toolkit
- Microsoft Visual Studio.NET, C/C++ and Visual Basic 6
- LabVIEW
- MATLAB

For more information, please visit www.agilent.com/find/U2300A.

Figure 1 The Agilent Measurement Manager software user interface



ELECTRICAL SPECIFICATIONS

Basic Multifunction USB DAQ

Model Number	U2351A	U2352A	U2353A	U2354A
Analog Input				
Resolution	16 bits, no missing codes			
Number of channels	16 SE/8 DI (software selectable/ch)			
Maximum sampling rate	250 kSa/s		500 kSa/s	
Scan list memory	Up to 100 selectable channel entries			
Programmable bipolar input range	±10 V, ±5 V, ±2.5 V, ±1.25 V			
Programmable unipolar input range	0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V			
Input coupling	DC			
Input impedance	1 GΩ / 100 pF			
Operational common mode voltage range	±7.5 V maximum			
Overvoltage protection	Power on: Continuous ±30 V, Power off: Continuous ±15 V			
Trigger sources	External analog/digital trigger, SSI/star trigger[1]			
Trigger modes	Pre- trigger, delay-trigger, post-trigger and middle-trigger			
FIFO buffer size	Up to 8 MSa			
Analog Output				
Resolution	16 bits	N/A	16 bits	N/A
Number of channels	2	N/A	2	N/A
Maximum update rate	1 MSa/s	N/A	1 MSa/s	N/A
Output ranges	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF[2]	N/A	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF[2]	N/A
Output coupling	DC	N/A	DC	
Output impedance	0.1 Ω typical	N/A	0.1 Ω typical	N/A
Stability	Any passive load up to 1500 pF	N/A	Any passive load up to 1500 pF	N/A
Power on state	0 V steady state	N/A	0 V steady state	N/A
Trigger sources	External analog/digital trigger, SSI/star trigger[1]	N/A	External analog/digital trigger, SSI/star trigger[1]	N/A
Trigger modes	Post-trigger and delay-trigger	N/A	Post-trigger and delay-trigger	N/A
FIFO buffer size	1 channel: Maximum 8 MSa 2 channels: Maximum 4 MSa/ch	N/A	1 channel : 8 MSa 2 channels : Maximum 4 MSa/ch	N/A
Function generation mode	Sine, square, triangle, sawtooth and noise waveforms	N/A	Sine, square, triangle, sawtooth and noise waveforms	N/A
Digital I/O				
Number of channels	24-bit programmable input/output			
Compatibility	TTL			
Input voltage	V_{IL} = 0.7 V max, I_{IL} = 10 µA max V_{IH} = 2.0 V min, I_{IH} = 10 µA max			
Input voltage range	–0.5 V to +5.5 V			
Output voltage	V_{OL} = 0.45 V max, I_{OL} = 8 mA max V_{OH} = 2.4 V min, I_{OH} = 400 µA max			

General Purpose Digital Counter (GPC)	
Maximum count	(2^{31}–1) bits
Number of channels	2 independent up/down counter
Compatibility	TTL
Clock source	Internal or external
Base clock available	48 MHz
Maximum clock source frequency	12 MHz
Input frequency range	0.1 Hz to 6 MHz at 50% duty cycle
Pulse width measurement range	0.167 µs to 178.956 s
Analog Trigger	
Trigger source	All analog input channels, External analog trigger (EXTA_TRIG)
Trigger level	±Full scale for internal; ±10 V for external
Trigger conditions	Above high, below low and window (software selectable)
Trigger level resolution	8 bits
Bandwidth	400 kHz
Input impedance for EXTA_TRIG	20 kΩ
Coupling	DC
Overvoltage protection	Continuous for ± 35 Vmaximum
Digital Trigger	
Compatibility	TTL/CMOS
Response	Rising or falling edge
Pulse width	20 ns minimum
Calibration[3]	
On board reference voltage	5 V
Temperature drift	±2 ppm/°C
Stability	±6 ppm/1000 hrs
General	
Remote interface	USB 2.0 High Speed
Device class	USBTMC class device
Programmable interface	Standard Commands for Programmable Instruments (SCPI) and IVI-COM

[1] System Scynchronous Interface (SSI) and star trigger commands are used when the modular device is incorporated into the chassis.
[2] Maximum external reference voltage for analog output channels (AO_EXT_REF) is ±10 V.
[3] 20 minutes warm-up time is recommended.

High Density Multifunction USB DAQ

Model Number	U2355A	U2356A	U2331A
Analog Input			
Resolution	16 bits, no missing codes		12 bits, no missing codes
Number of channels	64 SE/32 DI (software selectable/ch)		
Maximum sampling rate	250 kSa/s	500 kSa/s	3 MSa/s (single channel) 1 MSa/s (multiple channels)
Scan list memory	Up to 100 selectable channel entries		
Programmable bipolar input range	±10 V, ±5 V, ±2.5 V, ±1.25 V		±10 V, ±5 V, ±2.5 V, ±1.25 V, ±1 V, ±0.5 V, ±0.25 V, ±0.2 V, ±0.05 V
Programmable unipolar input range	0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V		0 to 10 V, 0 to 5 V, 0 to 4 V, 0 to 2.5 V, 0 to 2 V, 0 to 1 V, 0 to 0.5 V, 0 to 0.4 V, 0 to 0.1V
Input coupling	DC		
Input impedance	1 GΩ / 100 pF		
Operational common mode voltage range	±7.5 V maximum		
Overvoltage protection	Power on: Continuous ±30 V; Power off: Continuous ±15 V		
Trigger sources	External analog/digital trigger, SSI/star trigger[1]		
Trigger modes	Pre-trigger, delay-trigger, post-trigger and middle-trigger		
FIFO buffer size	Up to 8 MSa		
Analog Output			
Resolution	12 bits		
Number of channels	2		
Maximum update rate	1 MSa/s		
Output ranges	0 to 10 V, ±10 V, 0 to AO_EXT_REF, ±AO_EXT_REF[2]		
Output coupling	DC		
Output impedance	0.1 Ω typical		
Stability	Any passive load up to 1500 pF		
Power on state	0 V steady state		
Trigger sources	External analog/digital trigger, SSI/star trigger[1]		
Trigger modes	Post-trigger and delay-trigger		
FIFO buffer size	1 channel: Maximum 8 MSa 2 channels: Maximum 4 MSa/ch		
Function generation mode	Sine, square, triangle, sawtooth and noise waveforms		
Digital I/O			
Number of channels	24-bit programmable input/output		
Compatibility	TTL		
Input voltage	V_{IL} = 0.7 V max, I_{IL} = 10 µA max V_{IH} = 2.0 V min, I_{IH} = 10 µA max		
Input voltage range	–0.5 V to +5.5 V		
Output voltage	V_{OL} = 0.45 V max, I_{OL} = 8 mA max V_{OH} = 2.4 V min, I_{OH} = 400 µA max		
General Purpose Digital Counter (GPC)			
Maximum count	$(2^{31}–1)$ bits		
Number of channels	2 independent up/down counter		
Compatibility	TTL		
Clock source	Internal or external		
Base clock available	48 MHz		
Maximum clock source frequency	12 MHz		
Input frequency range	0.1 Hz to 6 MHz at 50% duty cycle		
Pulse width measurement range	0.167 µs to 178.956 s		

Analog Trigger	
Trigger source	All analog input channels, External analog trigger (EXTA_TRIG)
Trigger level	±Full scale for internal; ±10 V for external
Trigger conditions	Above high, below low and window (software selectable)
Trigger level resolution	8 bits
Bandwidth	400 kHz
Input impedance for EXTA_TRIG	20 kΩ
Coupling	DC
Overvoltage protection	Continuous for ±35 V maximum
Digital Trigger	
Compatibility	TTL/CMOS
Response	Rising or falling edge
Pulse width	20 ns minimum
Calibration[3]	
On board reference	5 V
Temperature drift	±2 ppm/°C
Stability	±6 ppm/1000 hrs
General	
Remote interface	USB 2.0 High Speed
Device class	USBTMC class device
Programmable interface	Standard Commands for Programmable Instruments(SCPI) and IVI-COM

[1] System Scynchronous Interface (SSI) and star trigger commands are used when the modular device is incorporated into the chassis.
[2] Maximum external reference voltage for analog output channels (AO_EXT_REF) is ±10 V.
[3] 20 minutes warm-up time is recommended.

ELECTRICAL MEASUREMENT SPECIFICATIONS

Basic Multifunction USB DAQ

Analog Input Measurement[1]				
Model Number	**U2351A/U2352A**		**U2353A/U2354A**	
Function	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**
Offset error	±1 mV	±5 mV	±1 mV	±5 mV
Gain error	±2 mV	±5 mV	±2 mV	±5 mV
–3 dB small signal bandwidth	760 kHz		1.5 MHz	
1% THD large signal bandwidth	300 kHz		300 kHz	
System noise	1 mVrms	2 mVrms	1 mVrms	2.5 mVrms
CMRR	62 dB		62 dB	
Spurious-free dynamic range (SFDR)	88 dB		82 dB	
Signal-to-noise and distortion ratio (SINAD)	80 dB		78 dB	
Total harmonic distortion (THD)	–90 dB		–88 dB	
Signal-to-noise ratio (SNR)	80 dB		78 dB	
Effective number of bits (ENOB)	13		12.6	

Analog Output Measurement[1]		
Model Number	**U2351A/U2353A**	
Function	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**
Offset error	±1 mV	±4 mV
Gain error	±4 mV	±5 mV
Slew rate	19 V/µs	
Rise time	0.7 µs	0.8 µs
Fall time	0.7 µs	0.8 µs
Settling time to 1% output error	4 µs	
Driving capability	5 mA	
Glitch energy	5 ns-V (typical), 80 ns-V (maximum)	

High Density Multifunction USB DAQ

Analog Input Measurement[1]						
Model Number	**U2355A**		**U2356A**		**U2331A**	
Function	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**
Offset error	±1 mV	±2 mV	±1 mV	±2 mV	±2 mV	±3 mV
Gain error	±2 mV	±3 mV	±2 mV	±6 mV	±6 mV	±7.5 mV
–3 dB small signal bandwidth	760 kHz		1.3 MHz		1.2 MHz	
1% THD large signal bandwidth	400 kHz		400 kHz		N/A	
System noise	1 mVrms	2 mVrms	1 mVrms	4 mVrms	3 mVrms	5 mVrms
CMRR	64 dB		61 dB		62 dB	
Spurious-free dynamic range (SFDR)	88 dB		86 dB		71 dB	
Signal-to-noise and distortion ratio (SINAD)	80 dB		78 dB		72 dB	
Total harmonic distortion (THD)	–90 dB		–90 dB		–76 dB	
Signal-to-noise ratio (SNR)	80 dB		78 dB		72 dB	
Effective number of bits (ENOB)	13		12.6		11.6	

Analog Output Measurement[1]				
Model Number	**U2355A/U2356A**		**U2331A**	
Function	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**	**23 °C ± 5 °C**	**0 °C to 18 °C 28 °C to 45 °C**
Offset error	±1 mV	±4 mV	±1.5 mV	±3 mV
Gain error	±4 mV	±5 mV	±4 mV	±5 mV
Slew rate	19 V/µs		19 V/µs	
Rise time	0.7 µs	0.8 µs	0.7 µs	0.8 µs
Fall time	0.7 µs	0.8 µs	0.7 µs	0.8 µs
Settling time to 1% output error	4 µs		4 µs	
Driving capability	5 mA		5 mA	
Glitch energy	5 ns-V(typical), 80 ns-V (maximum)		5 ns-V(typical), 80 ns-V (maximum)	

[1] Specifications are for 20 minutes of warm-up time, calibration temperature at 23 °C and input range of ±10 V.

TEST CONDITIONS

Dynamic Range Test	Model Number	Test Conditions[2]	
SFDR, THD, SINAD, SNR, ENOB	U2351A U2352A U2355A	Sampling rate: Fundamental frequency: Number of points: Fundamental input voltage:	250 kSa/s 2.4109 kHz 8192 FSR –1 dB FS
	U2353A U2354A U2356A	Sampling rate: Fundamental frequency: Number of points: Fundamental input voltage:	500 kSa/s 4.974 kHz 16384 FSR –1 dB FS
	U2331A	Sampling rate: Fundamental frequency: Number of points: Fundamental input voltage:	3 MSa/s 29.892 kHz 65536 FSR –1 dB FS

Dynamic Range Test	Model Number	Test Conditions[2]	
• –3 dB small signal bandwidth • 1% THD large signal bandwidth	U2351A U2352A U2355A	Sampling rate: Input voltage: • –3dB small signal bandwidth • 1% THD large signal bandwidth	250 kSa/s 10% FSR FSR –1 dB FS
	U2353A U2354A U2356A	Sampling rate: Input voltage: • –3 dB small signal bandwidth • 1% THD large signal bandwidth	500 kSa/s 10% FSR FSR –1 dB FS
	U2331A	Sampling rate: Input voltage: • –3 dB small signal bandwidth • 1% THD large signal bandwidth	3 MSa/s 10% FSR FSR –1 dB FS

[2] DUT setting at ±10 V bipolar.

GENERAL SPECIFICATIONS

REMOTE INTERFACE
USB 2.0 High Speed
USBTMC class device

POWER CONSUMPTION
+12 VDC, 550 mA maximum

OPERATING ENVIRONMENT
Operating temperature from 0 °C to +55 °C
Relative humidity at 15% to 85% RH (non-condensing)
Altitude up to 4600 meters

STORAGE COMPLIANCE
–20 °C to +70 °C

SAFETY COMPLIANCE
Certified with:
- IEC 61010-1:2001/EN 61010-1:2001 (2nd Edition)
- USA: UL61010-1: 2004
- Canada: CSA C22.2 No.61010-1:2004

EMC COMPLIANCE
Certified with:
- IEC/EN 61326-1 1998
- CISPR 11: 1990/EN55011:1991, Group 1, Class A
- CANADA: ICES-001: 1998
- Australia/New Zealand: AS/NZS 2064.1

SHOCK and VIBRATION
Tested to IEC/EN 60068-2

IO CONNECTOR
68-pin female VHDCI Type

DIMENSION (WxDxH)
- 120 mm x 182.40 mm x 44 mm (with plastic casing)
- 105 mm x 174.54 mm x 25 mm (without plastic casing)

WEIGHT
- 565 g (with plastic casing)
- 400 g (without plastic casing)

WARRANTY
One year

SOFTWARE REQUIREMENTS

Agilent connectivity software included
Agilent IO Libraries Suite 14.2

Minimum system requirements (IO libraries and drivers)

PC hardware	500 MHz Pentium III or higher, 256 MB RAM, 40 GB hard disk space, CD-ROM drive
Operating system	Windows 2000 and above

Computer interface High Speed USB 2.0

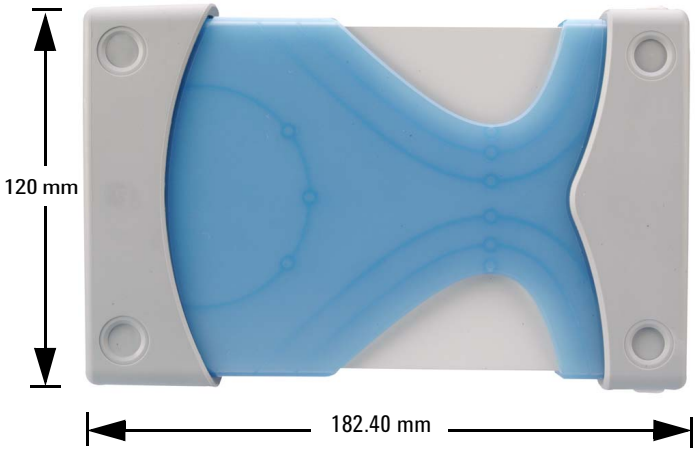
Software driver support for programming languages
Software driver : IVI-COM
Compatible with programming environments:
Agilent VEE, Agilent T&M Toolkit
Microsoft Visual Studio.NET, C/C++
Visual Basic 6
LabVIEW
MATLAB

PRODUCT OVERVIEW

FRONT VIEW

REAR VIEW

TOP VIEW



Standard Shipped Components:

- USB interface cable
- L-Mount Kit (used with modular instrument chasis)
- Quick Start Guide
- Certificate of Calibration (CoC)
- Product Reference CD-ROM
- Agilent IO Libraries Suite 14.2 CD-ROM

Optional Accessories:

- U2901A - Terminal Board and SCSI-II 68 pin connector with 1-meter cable
- U2902A - Terminal Board and SCSI-II 68 pin connector with 2-meter cable
- U2781A 6-slot USB modular instrument chassis

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