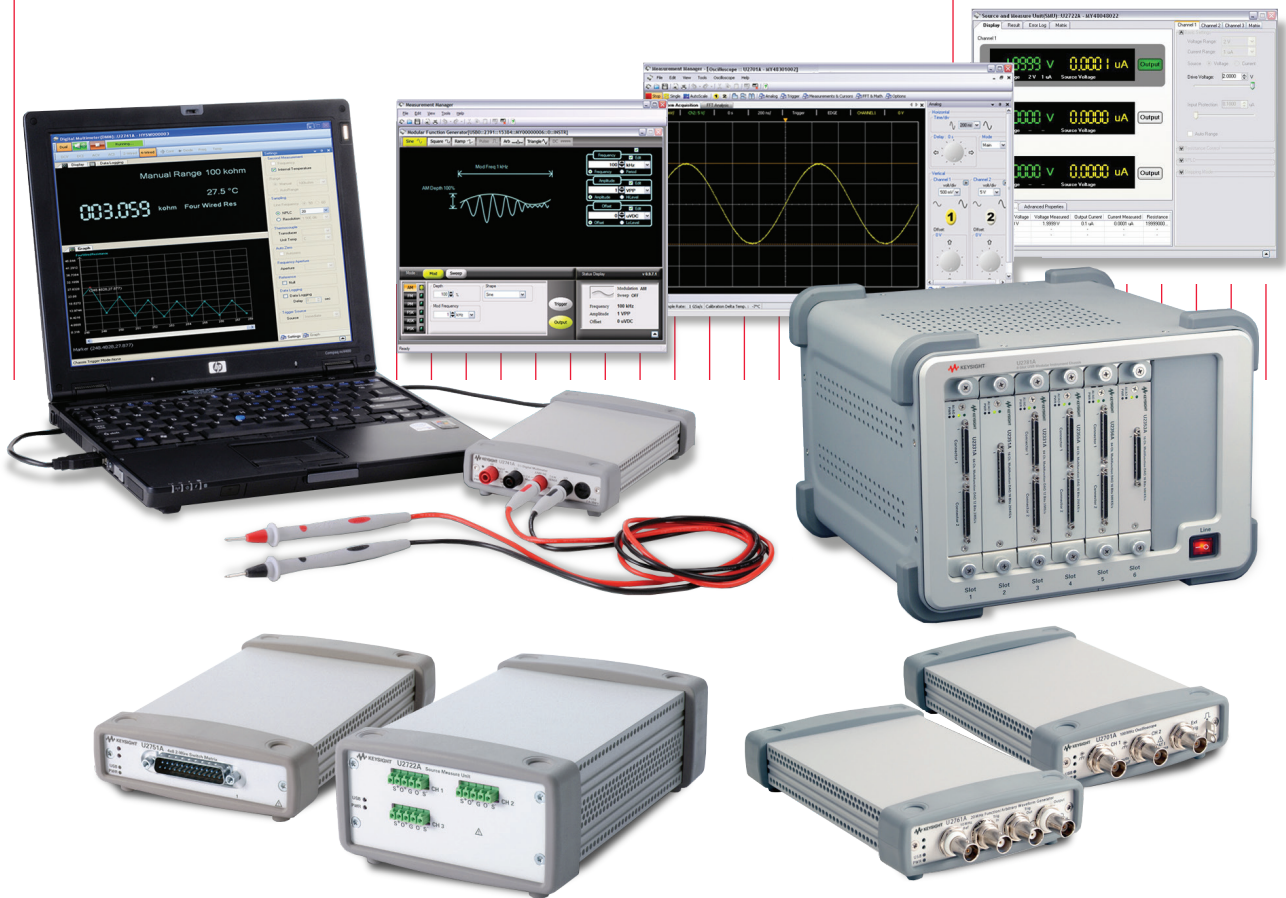


# Keysight Technologies

## Easily Arrange and Rearrange your Tests

USB modular instruments and USB data acquisition modules make it possible

Data Sheet



## Easily Arrange and Rearrange your Tests

One day you're working on the bench and the next you're working offsite. On the bench, you may need a small system in a compact chassis. Offsite, you may want to carry two or three essential instruments in your briefcase along with a laptop PC. The Keysight Technologies, Inc. growing family of USB-based modular instruments is designed to support a variety of applications—electronic functional test, product and process troubleshooting, data acquisition, data logging, educational settings and more.

These paperback-sized modules provide the flexibility of standalone or chassis-based operation, letting you easily measure, analyze and move on to your next challenge. Kick start your measurements with a USB interface to your PC and the familiar, easy-to-use soft front panel—the feature-packed Keysight Measurement Manager (KMM) software included with each instrument. You can easily arrange and rearrange your configuration as your needs change from day to day.

### Keysight USB Modular Instruments

Put a bench in your bag



The next time you're called out to solve tough problems in electronic products or processes, leave the bulky transit cases behind. With Keysight's USB modular instrument (MI) family, you can easily carry powerful test gear in your bag along with your laptop PC.

Our line of MIs includes two oscilloscopes, a DMM, a function generator with arbitrary waveform capability, a source/measure unit and a 4x8 switch matrix. All provide USB 2.0 connectivity (with USBTMC-USB488 standard) and plug-and-play simplicity for easy use on the go or on the bench.

Product descriptions begin on page 4.

### Keysight USB Data Acquisition

Control, acquire, measure, evolve

The USB data acquisition (DAQ) family gives you the choice and flexibility to create solutions that evolve and expand according to your changing measurement needs. You can quickly and easily acquire, measure and analyze data from electrical, mechanical, physical and acoustical phenomena.

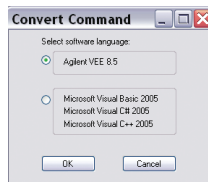
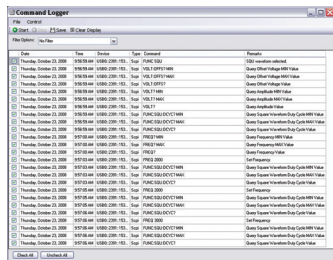
The DAQ series includes multifunction measurement modules, simultaneous-sampling measurement modules, two types of digital input/output (DIO) devices, and a thermocouple input. All can be used side-by-side with Keysight USB MI modules—standalone or in the six-slot chassis. All modules provide USB 2.0 connectivity (with USBTMC-USB488 standard) and plug-and-play simplicity.

Product descriptions and comparisons begin on page 14.

## A familiar interface

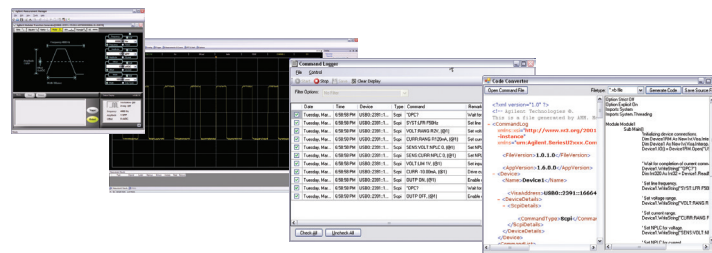
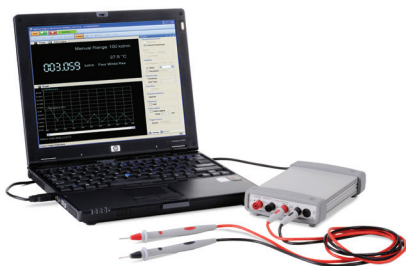
### Keysight Measurement Manager

The Keysight Measurement Manager (KMM) software is an application data viewer designed to help you perform quick configuration and measurement acquisition. Through individual windows on your PC screen, the AMM software provides a user-friendly front-panel interface for Keysight's USB Modular Data Acquisition modules (U2300A Series, U2500A Series, U2600A Series), U2700A Series USB Modular Instruments including U2781A instrument chassis and U2802A thermocouple signal conditioning to enable flexible analysis of measured data. This software include two special features - the command logger and code converter capabilities to further ease your programming tasks, which are available for all USB modular products.



Convert Command Logger files to snippets of VEE, VB, C++, and C# codes

Capture and review configuration commands or convert the commands to snippets of VEE, VB, C++, and C# codes



#### Hardware Requirements

Processor	1.6 GHz Pentium IV or higher
Operating System	One of the following Microsoft Windows versions: <ul style="list-style-type: none"> <li>- Windows XP Professional or Home edition (Service Pack 1 or later)</li> <li>- Windows Vista 32-bit (Business, Ultimate, Enterprise, Home Basic, and Home Premium edition)</li> </ul>
Hard Disk Space	1 GB
RAM	512 MB or higher recommended
Video	Super VGA (800 x 600), 256 colors or more

#### Software Requirements

- Keysight IO Libraries Suite 15.1 or higher <sup>1</sup>
- Keysight T&M Toolkit Runtime version 2.1 <sup>2</sup>
- Keysight T&M Toolkit Redistributable Package 2.1 patch <sup>2</sup>
- Microsoft.NET Framework version 2.0 <sup>2</sup>

For more information, please see [www.keysight.com/find/AMM](http://www.keysight.com/find/AMM).

1. Available on the Keysight Automation-Ready CD-ROM.  
 2. Bundled with Keysight Measurement Manager software application installer.

## USB Modular Instruments: Put a Bench in your Bag

### Waveform measurement and analysis

#### U2701A/U2702A USB modular two-channel oscilloscopes



These USB scopes are available with bandwidths of either 100 MHz (U2701A) or 200 MHz (U2702A). Both provide 500 MSa/s sampling and 16 Mpts of memory per channel (1 GSa/s and 32 Mpts with two channels interleaved) to help you gain better insight into signal details. Advanced analysis capabilities built into the AMM scope software include waveform math and FFT with windowing. Other advanced features include:

- Normal, averaging and peak-detect acquisition modes
- Advanced triggering including edge, pulse width and line-selectable video
- Manual, auto and tracking cursors with DT, DV and frequency measurements
- Over 25 measurement and math functions
- 1,024-point FFT with Hanning, Hamming, Blackman-Harris, Rectangular and Flat Top windowing functions
- Dual-screen display with FFT function and keyboard shortcut keys (with AMM software)

With the included IVI-COM drivers, these scopes are compatible with popular development environments including Keysight VEE, Microsoft Visual Studio.NET, C/C++ and Visual Basic 6, the Microsoft .NET Framework and LabVIEW.

Their small size makes these scopes ideal for standalone bench use as well as integration into system solutions with the U2781A chassis. Hi-Speed USB 2.0 compatibility makes connection to a PC quick and easy.

For complete specifications of U2701A/U2702A, please download the datasheet from [www.keysight.com/find/usbscope](http://www.keysight.com/find/usbscope).

### Accessories

Each scope includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable and a passive probe (N2862A with U2701A; N2863A with U2702A). The table presents optional items that may be useful to you.

Item	Model number
1:1 20 MHz passive probe	10070C
10:1 150 MHz passive probe, 1.2 m (for U2701A)	N2862A
10:1 300 MHz passive probe, 1.2 m (for U2702A)	N2863A
Six-slot USB MI chassis	U2781A
BNC cable	U2921A-100
USB secure cable, 2 m	U2921A-101



N2862A, 10:1 150 MHz passive probe, 1.2 m (for U2701A)



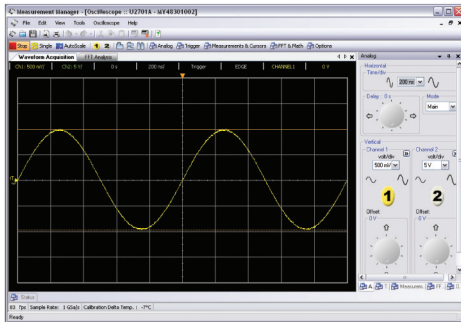
10070C, 1:1 20 MHz passive probe

### Dimensions (W x D x H)

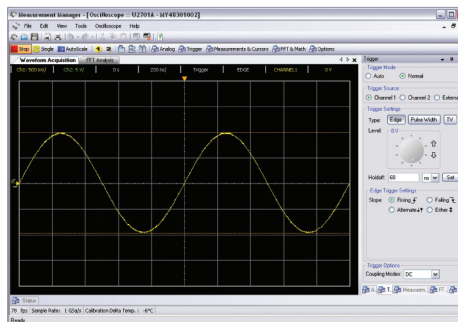
117.00 x 180.00 x 41.00 mm with rubber bumpers (4.61 x 7.09 x 1.61 in)

105.00 x 175.00 x 25.00 mm without bumpers (4.13 x 6.89 x 0.98 in)

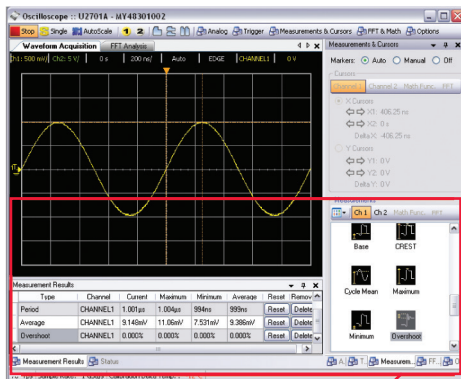
## Waveform Measurement and Analysis (continued)



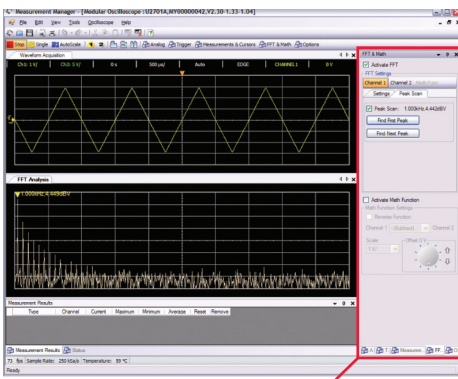
Measure waveforms quickly and easily with the instrument-like AMM interface.



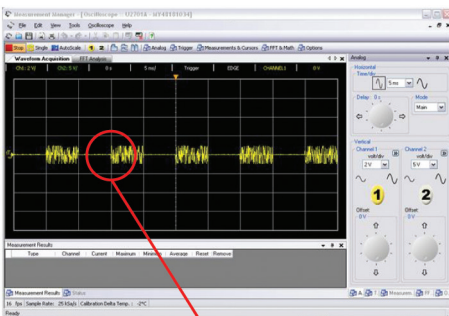
Capture waveforms with capabilities such as edge, pulse-width and TV triggering.



Simplify waveform analysis with automatic measurements such as rise time and duty cycle, and the measurement results panel.



Explore frequency domain characteristics of measured waveforms using FFT analysis (with five windowing functions) and search for peak values of the FFT.



Capture signal details effectively with deep memory.

## USB Modular Instruments: Put a Bench in your Bag (continued)

### Fundamental measurements with 5½ digits

#### U2741A USB modular digital multimeter



The U2741A USB DMM provides a broad range of essential features and 10 measurement functions: DC voltage and DC current; true-RMS AC voltage and AC current; two- and four-wire resistance; frequency; diode test; continuity; and temperature.

- Make fast measurements with up to 100 readings/second
- Measure up to 300 Vdc with 5½ digits resolution
- Utilize wide measurement ranges: 100 mVdc to 300 Vdc and 10 mA to 2 A
- Dual display mode allows viewing of second measurement (temperature or frequency)
- Integrated data logging capability
- Bundled AMM software is made even easier with keyboard shortcut keys

With the included IVI-COM drivers, this DMM is compatible with a variety of popular development environments. The U2741A is ready to be programmed directly using SCPI commands, and the included Command Logger and Code Converter tools simplify programming tasks.

Its small size makes this DMM ideal for standalone use on the bench as well as integration into system solutions. Flexible chassis triggering (master/slave/star/none) enables effective multi-DMM systems.

For complete specifications of U2741A, please download the datasheet from [www.keysight.com/find/U2741A](http://www.keysight.com/find/U2741A).

### Accessories

The DMM includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable, test leads and an L-mount kit (for use in the U2781A chassis). The table summarizes additional items that may be useful to you.

Item	Model number
Test lead set	34138A
Temperature thermistor probe	E2308A
Six-slot USB MI chassis	U2781A
USB secure cable, 2 m	U2921A-101



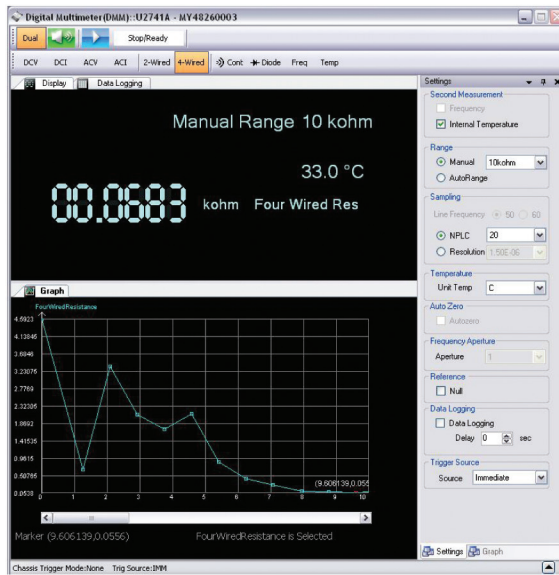
34138A, test lead set

### Dimensions (W x D x H)

117.00 x 180.00 x 41.00 mm with rubber bumpers (4.61 x 7.09 x 1.61 in)

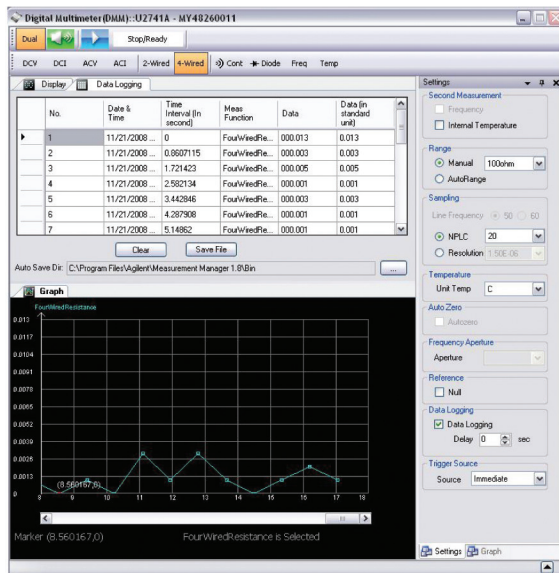
105.00 x 175.00 x 25.00 mm without bumpers (4.13 x 6.89 x 0.98 in)

## Fundamental measurements with 5½ digits (continued)



Simplify multitasking, or easily view multiple screens at once, with AMM's "compact" mode.

View voltage along with time using the "dual display" mode.



Perform data logging for capture and analysis of long-term events.

## USB Modular Instruments: Put a Bench in your Bag (continued)

### Basic signals and arbitrary waveforms

#### U2761A USB modular one-channel function generator



The U2761A USB function generator offers eleven standard signals as well as arbitrary waveforms. It relies on direct digital synthesis (DDS) to create stable, accurate output of low-distortion sine waves. The U2761A also provides square waves with fast rise and fall times up to 20 MHz and linear ramps up to 200 kHz. For simulation of real-world signals, use the waveform editor to create arbitrary waveforms with 14-bit resolution up to 200 kHz.

- 10 mVpp to 10 Vpp amplitude range
- Pulse generation with variable period, pulse width and amplitude
- Ramp, triangle, noise and DC waveforms
- AM, FM, PM, ASK, FSK, PSK signals
- 64 Kpt, 50 MSa/s arbitrary waveforms are customizable through the waveform editor
- Optional arbitrary waveform generation upgrade (2 MHz)

Internal modulation eliminates the need for a separate modulation source. Linear and logarithmic sweeps are also built in, with sweep rates from 1 ms to 500 s.

With the included IVI-COM drivers, this instrument is compatible with popular development environments. Hi-Speed USB 2.0 compatibility makes connection to a PC quick and easy.

For complete specifications of U2761A, please download the datasheet from [www.keysight.com/find/U2761A](http://www.keysight.com/find/U2761A).

### Accessories

The function generator includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable and an L-mount kit (for use in the U2781A chassis). The table presents three more items that may be useful.

Item	Model number
Six-slot USB MI chassis	U2781A
BNC cable	U2921A-100
USB secure cable, 2 m	U2921A-101
Arbitrary waveform generation upgrade to 2 MHz	U2010A
Arbitrary waveform generation upgrade bundle purchase with U2761A	U2010A-1FP



U2921A-100, BNC cable



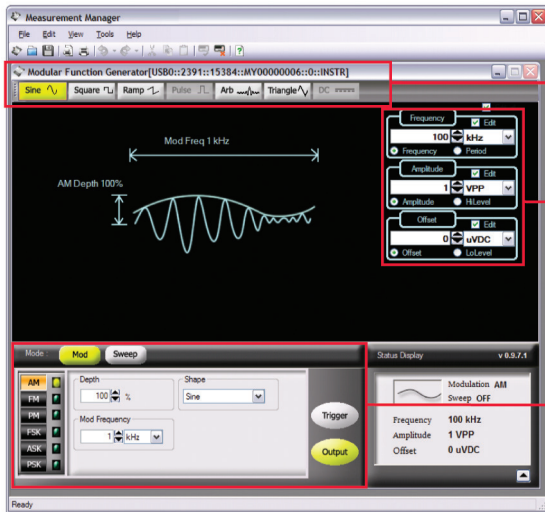
U2921A-101, USB secure cable, 2 m

### Dimensions (W x D x H)

117.00 x 180.00 x 41.00 mm with rubber bumpers (4.61 x 7.09 x 1.61 in)  
105.00 x 175.00 x 25.00 mm without bumpers (4.13 x 6.89 x 0.98 in )

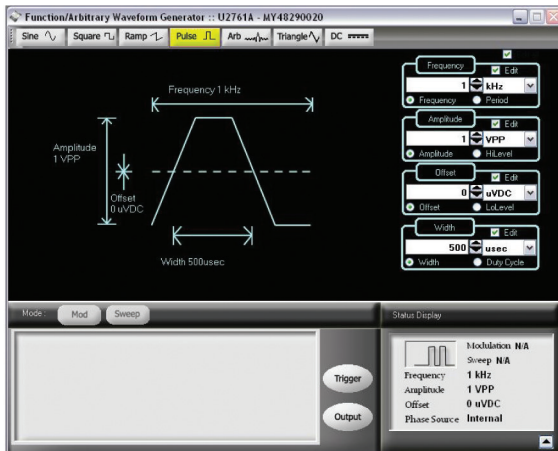


## Basic signals and arbitrary waveforms (continued)

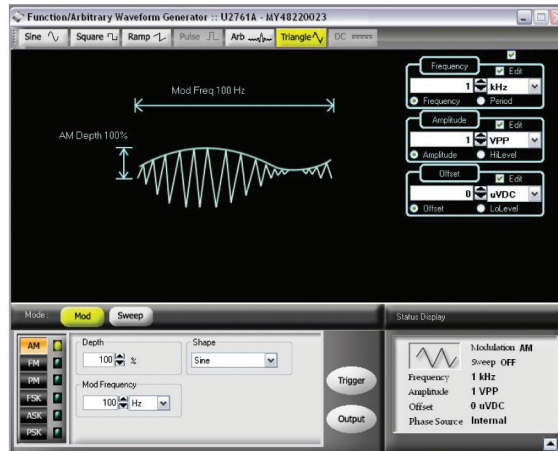


Quickly set up a variety of waveforms through the familiar AMM interface

Visualise modulated waveforms as you define their parameters



Generate pulses with variable period, width and amplitude



Utilize the 11 standard signals as well as arbitrary waveforms.



Define or draw your required arbitrary waveform using the waveform editor.

## USB Modular Instruments: Put a Bench in your Bag (continued)

### Voltage and current programming and readback

#### U2722A/U2723A USB modular source measure unit



The three-channel U2722A and its enhanced version, the U2723A are more than just power supplies – each delivers  $\pm 20$  V and  $\pm 120$  mA per channel with fast response time. The U2722A/U2723A also provides voltage and current programming/readback with high-accuracy measurement capabilities. The U2722A/U2723A is also capable of four-quadrant operation, acting as a current source and current sink (load) across its  $\pm 20$  V output range. Its measurement capabilities provide 0.1% accuracy and 100 pA sensitivity.

- Four-quadrant operation ( $\pm 20$  V,  $\pm 120$  mA)
- 100 pA measurement sensitivity with 16-bit resolution
- 0.1% basic accuracy
- Embedded test script (able to support three channels with coherent source and measurement capabilities) (for U2723A)
- IV Curve application support in the Keysight Measurement Manager software (for U2723A)
- Manager software (for U2723A)
- Faster rise/fall time (for U2723A)
- Supports SCPI and IVI-COM

Each of the three channels may be configured separately or in a matrix—in series or parallel. These versatile SMUs allows you to perform sweep and measurement with just a single device without extra configurations.

### Fixture for semiconductor testing

The U2941A parametric test fixture enables testing of pin-through-hole semiconductor components, with the U2722A/U2723A. The included Parametric Measurement Manager software also supports the U2751A switch matrix when used with the U2722A/U2723A.

For complete specifications of the source measure units and the parametric test fixture, please download the datasheets from [www.keysight.com/find/U2723A](http://www.keysight.com/find/U2723A) and [www.keysight.com/find/U2941A](http://www.keysight.com/find/U2941A) respectively.

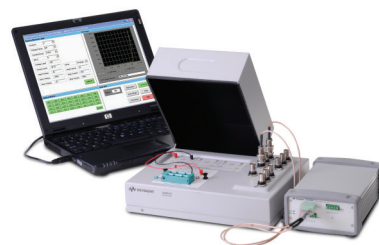
### Accessories

The SMU includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable, plug-in connectors and cable casing, and an L-mount kit (for use in the U2781A chassis). The table presents three more items that may be useful.

Item	Model number
Parametric test fixture	U2941A
Six-slot USB MI chassis	U2781A
USB secure cable, 2 m	U2921A-101

### Dimensions (W x D x H)

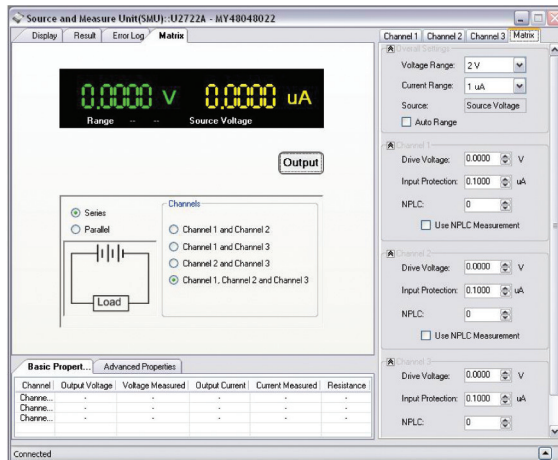
117.00 x 180.00 x 66.00 mm with rubber bumpers (4.61 x 7.09 x 2.60 in)  
105.00 x 175.00 x 50.00 mm without bumpers (4.13 x 6.89 x 1.97 in)



## Voltage and current programming and readback (continued)



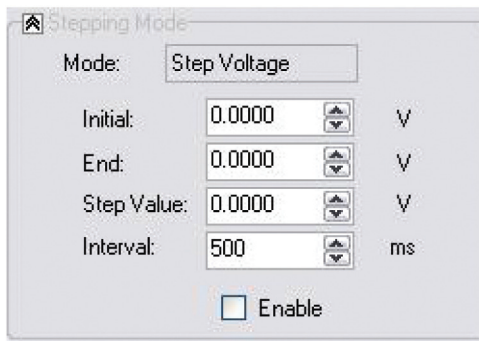
Configure all three channels separately to source or measure voltage or current.



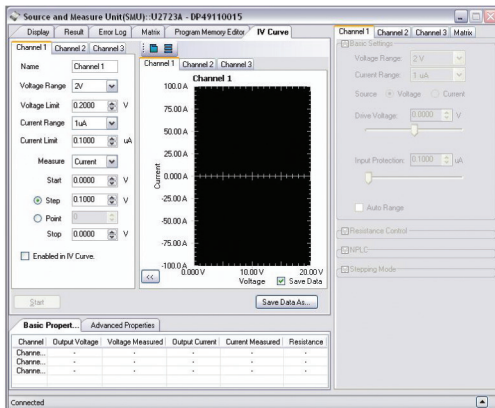
Combine channels for serial or parallel output.



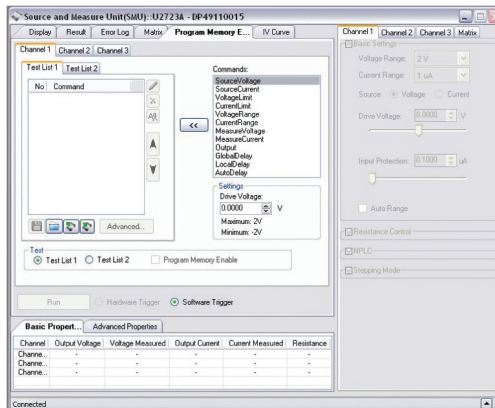
Perform short- and open-circuit testing through the resistance control capability.



Use the stepping mode to control U2722A/U2723A outputs (or measurements) as a function of time.



View the IV curve graph with just a click of a button (for U2723A)



Pre-define test configurations or duplicate tests easily with embedded test scripts (for U2723A)

## USB Modular Instruments: Put a Bench in your Bag (continued)

### Switching for test automation

#### U2751A USB modular switch matrix



The U2751A is a high-quality, low-cost switching solution for complex testing. It has 32 two-wire crosspoints in a 4x8 configuration, enabling connection with any combination of rows and columns—including multiple channels at the same time. Other key features are 45-MHz bandwidth (without terminal block), a relay cycle counter, and a commandlogger function.

- 32 two-wire crosspoints in a flexible 4x8 configuration
- Minimal crosstalk and insertion loss to 45 MHz
- Convenient user interface allows connections at the click of a mouse
- SCPI and IVI-COM supported

The AMM interface lets you make connections by simply using your mouse to click on crosspoints. The U2751A's flexible configuration enables testing of multiple DUTs as well as allowing different instruments to be connected to multiple points on a DUT at the same time.

### 32-channel terminal block

The U2922A terminal block is an optional accessory to the U2751A. The U2922A, which has screw-type terminals, provides a simple, convenient way to use the switch matrix for prototyping or final system deployment. It allows you to implement a wide variety of routing configurations and matrix topologies.

For complete specifications of U2751A, please download the datasheet from [www.keysight.com/find/U2751A](http://www.keysight.com/find/U2751A).

### Accessories

The switch matrix includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable, plug-in connectors and cable casing, and an L-mount kit (for use in the U2781A chassis). The table presents three more items that may be useful.

Item	Model number
32-channel terminal block	U2922A
Six-slot USB MI chassis	U2781A
USB secure cable, 2 m	U2921A-101

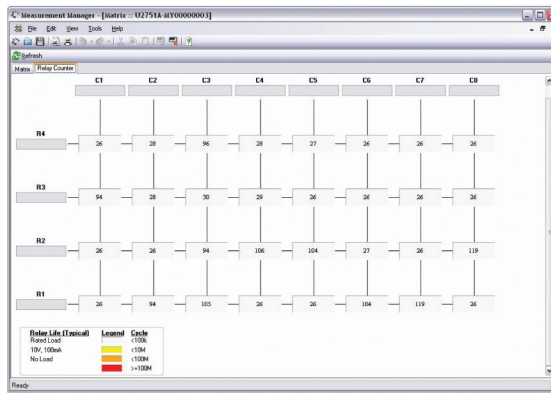
### Dimensions (W x D x H)

117.00 x 180.00 x 41.00 mm with rubber bumpers (4.61 x 7.09 x 1.61 in)  
 105.00 x 175.00 x 25.00 mm without bumpers (4.13 x 6.89 x 0.98 in )

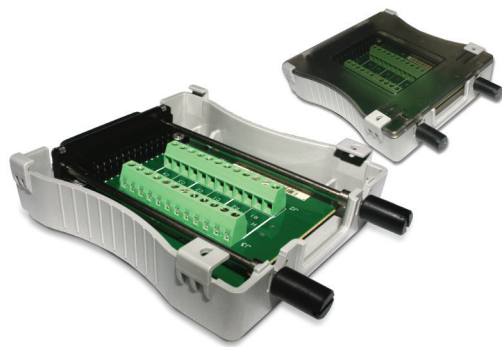
## Switching for test automation (continued)



Create instrument connections by simply clicking at the crosspoints within the visual AMM interface.



Use the built-in relay counter to monitor relay lifetime and performance.



Implement a variety of test topologies with the U2922A terminal block.

# USB DAQ: Control, Acquire, Measure, Evolve

## Basic and high-density DAQ

U2300A Series USB modular multifunction DAQ devices



This high-performance series consists of four basic models and three high-density models. The basic models feature 16 single-ended/eight differential inputs with 16-bit resolution and  $\pm 10$  V maximum range. The high-density models offer 64 single-ended/32 differential inputs with 16-bit resolution in the lower-speed models and the 12-bit resolution in high-speed U2331A.

- Up to 3 MSa/s sampling rate (single channel; U2331A)
- Up to 384 channels when used in U2781A chassis
- Powerful analog and digital triggering capabilities
- 24-bit programmable digital I/O
- Two analog outputs with function generator and arbitrary waveform capability (except U2352A/U2354A)
- Two general purpose digital timer/counter capabilities

The U2300A Series is compatible with wide range of application development environments (ADEs):

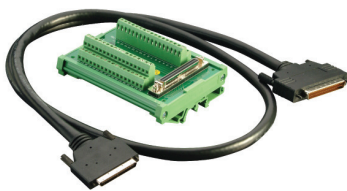
- Keysight VEE and Keysight T&M Toolkit
- MATLAB R2007a
- Microsoft Visual Studio .NET
- Microsoft C/C++
- Microsoft Visual Basic 6
- LabVIEW

For complete specifications of U2300A, please download the datasheet from [www.keysight.com/find/U2300A](http://www.keysight.com/find/U2300A).

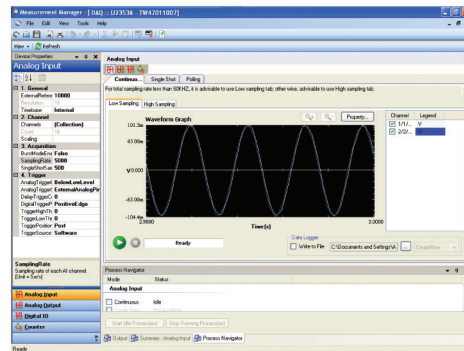
### Accessories

The SMU includes an AC/DC adapter, a USB Standard-A to Mini-B interface cable, plug-in connectors and cable casing, and an L-mount kit (for use in the U2781A chassis). The table presents three more items that may be useful.

Item	Model number
Terminal block and 1-m SCSI-II cable	U2901A
Terminal block and 2-m SCSI-II cable	U2902A
Six-slot USB MI chassis	U2781A1



U2901A, terminal block and 1-m SCSI-II cable



Configure easily and make measurements quickly using the intuitive AMM interface.

### Dimensions (W x D x H)

120.00 x 182.40 x 44.00 mm with plastic casing (4.72 x 7.18 x 1.73 in)

105.00 x 174.54 x 25.00 mm without plastic casing (4.13 x 6.87 x 0.98 in)

## Quick comparison: Basic DAQ table

	U2351A	U2352A	U2353A	U2354A
<b>Analog Input</b>				
Resolution	16 bits, no missing codes			
Number of channels	16 single-ended / 8 differential (software selectable per channel)			
Maximum sampling rate/ch	250 kSa/s /#1of channels used	500 kSa/s /#1 of channels used		
Scan list memory	Up to 100 selectable channel entries			
<b>Analog Output</b>				
Resolution	16 bits		16 bits	
Number of channels	2		2	
Maximum update rate	1 MSa/s	n/a	1 MSa/s	n/a
Function generator mode	Sine, square, triangle, sawtooth, and noise		Sine, square, triangle, sawtooth, and noise	
<b>Digital I/O</b>				
Number of channels	24-bit programmable input/output			
Compatibility	TTL			
<b>General Purpose Digital Counter</b>				
Maximum count	$(2^{31} - 1)$ bits			
Number of channels	Two independent up/down counters			
Input frequency range	0.1 Hz to 6 MHz at 50% duty cycle			
<b>Calibration<sup>2</sup></b>				
On-board reference voltage	5 V			
Temperature drift	$\pm 2$ ppm/ $^{\circ}$ C			
Stability	$\pm 6$ ppm/1000 hrs			

1 Denotes number

2 20-minute warm up time recommended

## Quick comparison: High-density DAQ

	U2355A	U2356A	U2331A
<b>Analog Input</b>			
Resolution	116 bits, no missing codes		12 bits, no missing codes
Number of channels	64 single-ended/32 differential (software selectable per channel)		
Maximum sampling rate/ch	(250 kSa/s)/(#3 of channels used)	(500 kSa/s)/(#3 of channels used)	Single channel: 3 MSa/s Multiple channels: 1 MSa/s
Scan list memory	Up to 100 selectable channel entries		
<b>Analog Output</b>			
Resolution	12 bits		
Number of channels	2		
Maximum update rate	1 MSa/s		
Function generator mode	Sine, square, triangle, sawtooth, and noise waveforms		
<b>Digital I/O</b>			
Number of channels	24-bit programmable input/output		
Compatibility	TTL		
<b>General Purpose Digital Counter</b>			
Maximum count	$(2^{31} - 1)$ bits		
Number of channels	Two independent up/down counters		
Input frequency range	0.1 Hz to 6 MHz at 50% duty cycle		
<b>Calibration<sup>4</sup></b>			
On-board reference voltage	5 V		
Temperature drift	$\pm 2$ ppm/ $^{\circ}$ C		
Stability	$\pm 6$ ppm/1000 hrs		

3. Denotes number

4. 20-minute warm up time recommended



## USB DAQ: Control, Acquire, Measure, Evolve (continued)

### Simultaneous signal acquisition

U2500A Series USB modular simultaneous-sampling multifunction DAQ devices



This family of three high-performance modules provides up to four channels per module with one analog-to-digital converter (ADC) for each channel. Maximum sampling rates are 2 MSa/s/ch in the U2531A (14 bits), 500 kSa/s/ch in the U2542A (16 bits) and 250 kSa/s/ch in the U2541A (16 bits).

- Dedicated ADC for each channel with up to 2 MSa/s/ch sampling
- Multifunction: Four analog inputs, two analog outputs, 24-bit programmable digital I/O, two general purpose digital counter and timer capabilities

The U2500A Series supports SCPI and IVI-COM as well as a wide range of languages and ADEs:

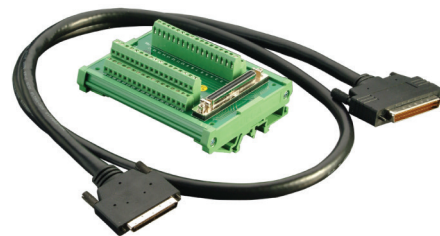
- Keysight VEE and Keysight T&M Toolkit
- MATLAB R2007a
- Microsoft Visual Studio .NET
- Microsoft C/C++
- Microsoft Visual Basic 6
- LabVIEW

For complete specifications of U2300A, please download the datasheet from [www.keysight.com/find/U2500A](http://www.keysight.com/find/U2500A).

### Accessories

Each U2500A Series module includes an AC/DC adapter, a USB extension cable and an L-mount kit (for use in the U2781A chassis). The table presents other items and accessories that may be useful.

Item	Model number
Terminal block and 1-m SCSI-II cable with 68-pin connector	U2901A
Terminal block and 2-m SCSI-II cable with 68-pin connector	U2902A
Six-slot USB MI chassis	U2781A



U2902A, terminal block and 2-m SCSI-II cable

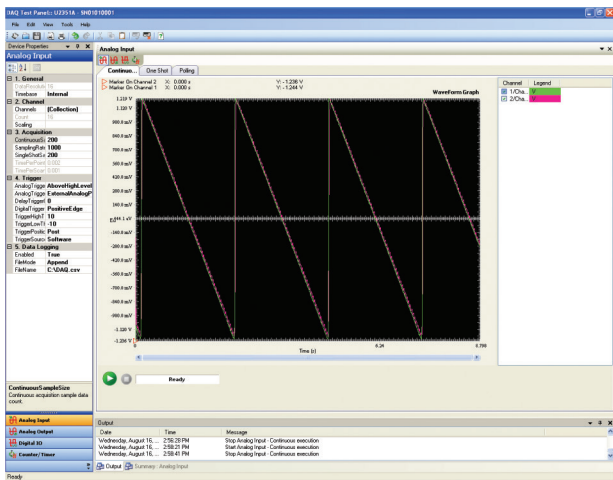
### Dimensions (W x D x H)

120.00 x 182.40 x 44.00 mm with plastic casing (4.72 x 7.18 x 1.73 in)  
 105.00 x 174.54 x 25.00 mm without plastic casing (4.13 x 6.87 x 0.98 in )

## Quick comparison: Simultaneous-sampling DAQ

	U2531A	U2541A	U2542A
<b>Analog Input</b>			
Resolution	14 bits		16 bits
Number of channels		4 differential input channels	
Maximum sampling rate/ch	2 MSa/s	250 kSa/s	500 kSa/s
Scan list memory	Up to 100 selectable channel entries		
<b>Analog Output</b>			
Resolution		12 bits	
Number of channels		2	
Maximum update rate		1 MSa/s	
Function generator mode	Sine, square, triangle, sawtooth, and noise waveforms		
<b>Digital I/O</b>			
Number of channels		24-bit programmable input/output	
Compatibility		TTL	
<b>General Purpose Digital Counter</b>			
Maximum count		$(2^{31} - 1)$ bits	
Number of channels		Two independent up/down counters	
Input frequency range		0.1 Hz to 6 MHz at 50% duty cycle	
<b>Calibration<sup>1</sup></b>			
On-board reference voltage		5 V	
Temperature drift		±2 ppm/°C	
Stability		±6 ppm/1000 hrs	

1. 20-minute warm up time recommended



Capture and save data in various formats (HTML, text or .xls) for analysis.

## USB DAQ: Control, Acquire, Measure, Evolve (continued)

### High channel count digital I/O

U2600A Series USB modular isolated digital I/O devices



The three U2600A modules offer digital input and output with high channel count and opto-isolation. Virtual port grouping lets you select any eight input or output bits and group them into a single channel as a virtual DIO port. An interrupt function automatically triggers your system when a digital change of state occurs.

- 32 or 64 opto-isolated digital input and output lines
- Up to 1250 Vrms of isolation protection on inputs and outputs
- Supports digital inputs of up to 24 V
- 5 to 35 V external supply voltage range for digital output
- On-board isolated +5 V, 150 mA (85 W) power supply

The U2600A Series supports SCPI and IVI-COM as well as a wide range of languages and ADEs:

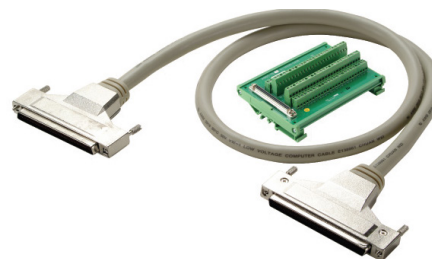
- Keysight VEE and Keysight T&M Toolkit
- MATLAB R2007a
- Microsoft Visual Studio .NET
- Microsoft C/C++
- Microsoft Visual Basic 6
- LabVIEW

For complete specifications of U2600A, please download the datasheet from [www.keysight.com/find/U2600A](http://www.keysight.com/find/U2600A).

### Accessories

Each U2600A Series module includes an AC/DC adapter, a USB extension cable and an L-mount kit (for use in the U2781A chassis). The table presents other items and accessories that may be useful.

Item	Model number
Terminal block and 1-m SCSI-II cable with 100-pin connector	U2903A
Terminal block and 2-m SCSI-II cable with 100-pin connector	U2904A
Six-slot USB MI chassis	U2781A



U2903A, terminal block and 1-m SCSI-II cable with 100-pin connector

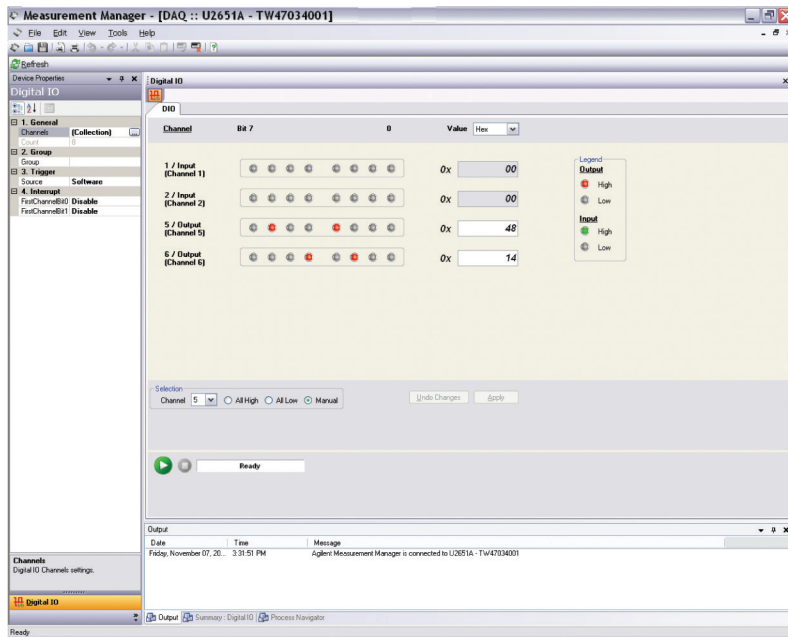
### Dimensions (W x D x H)

120.00 x 182.40 x 44.00 mm with plastic casing (4.72 x 7.18 x 1.73 in)

105.00 x 174.54 x 25.00 mm without plastic casing (4.13 x 6.87 x 0.98 in)

## Quick comparison: Digital input and output modules

	U2651A DIO Module	U2652A Digital Input Module	U2653A Digital Output Module
<b>Digital Input</b>			
Number of isolated bits	32	64	
Digital logic levels	High: 10-24 V; Low: 0-2 V		n/a
Input current (maximum)	1.5 mA per bit		
<b>Digital Output</b>			
Number of isolated bits	32		64
Output type	Open drain power MOSFET driver	n/a	Open drain power MOSFET driver
<b>General</b>			
Power consumption	+12 V at 235 mA (typ)	+12 V at 115 mA (typ)	+12 V at 260 mA (typ)
Connector type	100-pin SCSI-II		
Remote interface	Hi-Speed USB 2.0		



Control digital inputs and monitor digital outputs through the easy-to-use AMM interface.

## USB DAQ: Control, Acquire, Measure, Evolve (continued)

### Standalone digital I/O

U2100A Series USB digital I/O devices



This group of three standalone units offers cost-effective DIO for applications such as driving relays, actuators and valves. Equipped with opto-isolation, they can also act as an interface to industrial sensors. Capabilities such as a failsafe watchdog timer and programmable power-up states ensure safe, predictable operation.

- Up to 32 input terminals and 32 output terminals
- Supports digital inputs ranging from 0 to 24 V
- Opto-isolation with maximum transient voltage of 1500 Vpk
- Digital filtering removes unwanted glitches and pulses
- Edge detection monitors state changes on input lines (U2121A/U2122A)
- Fuse-protected output channels (shared by eight terminals)

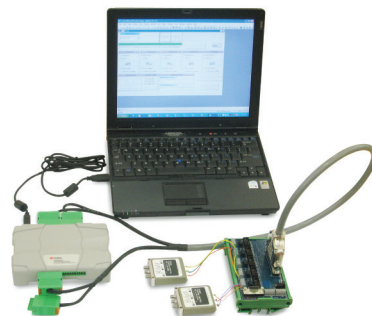
The U2100A Series supports IVI-COM as well as a wide range of languages and ADEs:

- Keysight VEE
- Microsoft Visual Studio .NET
- Microsoft C/C++
- Microsoft Visual Basic 6
- LabVIEW
- LabWindows/CVI

### RF switch driver

The U2121A is also part of a low-cost RF switch driver solution that includes the U2121A-101 adapter board. This five-channel solution is designed for small, simple test systems that contain up to five RF switches. Compatible Keysight RF switches include the 8762/63/64 coaxial switches, the 8765x microwave SPDT switches and the N1810/11/12 coaxial switches.

For complete specifications for the DIO modules and the RF switch driver, please download the datasheet from [www.keysight.com/find/U2100A](http://www.keysight.com/find/U2100A).



### Accessories

Each U2100A Series module includes an AC/DC adapter, a USB interface cable, a terminal block and a DIN rail clamp. The table presents another item that may be useful.

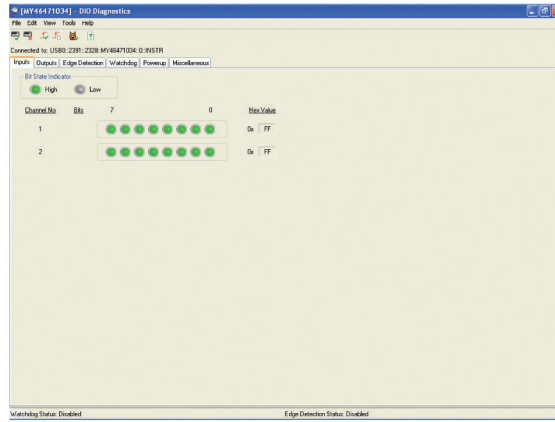
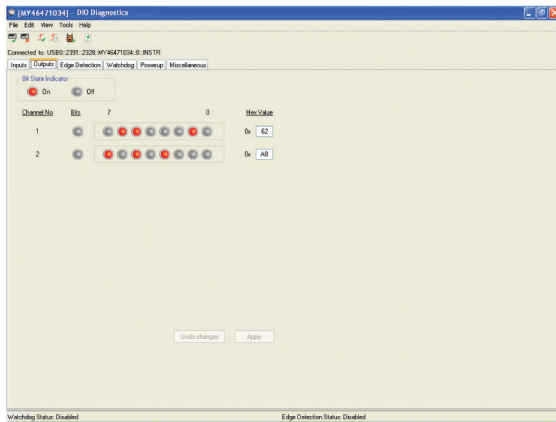
Item	Model number
RF switch driver board	U2121A-101

### Dimensions (W x D x H)

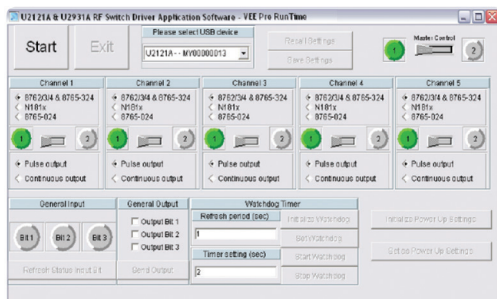
154.60 x 120.00 x 32.60 mm (6.09 x 4.72 x 1.28 in)

## Quick comparison: Standalone digital input and output modules

	U2121A DIO Module	U2122A Digital Input Module	U2653A Digital Output Module
<b>Digital I/O</b>			
Number of lines	16 input, 16 output	32 input	32 output
<b>Input characteristics</b>			
Input voltage	0 to 24 V		
Input logic voltage (low high)	< 1.3 V / > 3.5 V		n/a
Input propagation delay	100 μs (opto-isolator)		
<b>Output characteristics</b>			
Output load voltage (maximum)	24 V		24 V
Output low voltage	1.2 V	n/a	1.2 V
Output propagation delay	100 μs (opto-isolator)		100 μs (opto-isolator)
<b>Other features</b>			
Device type	Software timed		
Operating capabilities	<ul style="list-style-type: none"> <li>– Programmable</li> <li>– power-up states</li> <li>– Watchdog timer</li> <li>– Edge detection</li> <li>– Digital filter</li> </ul>	<ul style="list-style-type: none"> <li>– Edge detection</li> <li>– Digital filter</li> </ul>	<ul style="list-style-type: none"> <li>– Programmable power-up states</li> <li>– Watchdog timer</li> </ul>



Set digital inputs and observe the status of outputs easily.



Control up to five RF switches and configure the watchdog timer, edge detection and digital filter applications using the RF Switch Driver Application software.

## USB DAQ: Control, Acquire, Measure, Evolve (continued)

### Temperature measurements for thermal analysis

#### U2802A 31-channel thermocouple input module



The Keysight U2802A thermocouple input module is a signal conditioner that converts low-voltage thermocouple signals into a  $\pm 10$  volt signal range. The module is designed to be used with the U2355A and U2356A multifunction DAQ modules, connected through two SCSI-II cables. The U2802A is suitable for a wide range of applications in a variety of industrial environments:

- Supports thermocouple types J, K, R, S, T, N, E and B
- Includes built-in isothermal terminal block, thermistor and zeroing function
- Provides error detection of open thermocouples
- Independently configurable for thermocouple or voltage input mode on any channel
- Handles input voltages up to 10 V
- NIST-traceable calibration

Configuration and control is performed through the easy-to-use AMM software, which is included with the U2802A. The module is also compatible with a wide range of application development environments including Keysight VEE, LabVIEW and Microsoft Visual Studio.

For complete specifications of U2802A, please download the datasheet from [www.keysight.com/find/U2802A](http://www.keysight.com/find/U2802A).

### Accessories

The U2802A includes one J-type thermocouple, a power supply splitter and two SCSI-II 68-conductor cables (1 m). The table presents three more items that may be useful.

Item	Model number
Power supply adapter	U2802A-001
J-type thermocouples (10 pieces)	U2802A-100
Two 2-m SCSI-II cables	U2802A-201
Two 1-m SCSI-II cables	U2802A-202



U2802A-100, J-Type Thermocouple Kit

### Dimensions (W x D x H)

159.7 x 254.2 x 40.5 mm (6.3 x 10 x 1.6 in)

## Temperature measurements for thermal analysis (continued)

The screenshot displays the Measurement Manager software interface for a DAQ device (U2355A - TW47222001). The main window is titled "Analog Input" and shows the configuration for a continuous measurement. The left sidebar contains a tree view with sections for General, Channel, Acquisition, and Trigger. The main area features a "Waveform Graph" showing a signal over time, with a "Ready" button and a "Data Logger" section. The bottom of the window shows an "Output" window with a log of events.

**General Settings:**

- ExternalReferen: 10000
- Resolution: 15
- SignalCondition: U2802A
- Timebase: Internal

**Channel Settings:**

- Channels: (Collection)
- Count: 64
- Scaling: (Collection)

**Acquisition Settings:**

- BurstModeEnab: False
- SamplingRate: 1000
- SingleShotSamp: 500

**Trigger Settings:**

- AnalogTriggerC: BelowLowLevel
- AnalogTriggerS: ExternalAnalogPin
- DelayTriggerCou: 0
- DigitalTriggerPol: PositiveEdge
- TriggerHighTrie: 0
- TriggerLowTrie: 0
- TriggerPosition: Post
- TriggerSource: Software

**Waveform Graph:**

The graph shows a signal labeled "Unit" on the y-axis (ranging from 1.800 to 40.00) and "Time [s]" on the x-axis (ranging from 13.900 to 14.000). The signal is a noisy line fluctuating around a mean value of approximately 2.0. A "Ready" button is located below the graph.

**Data Logger:**

- Write to File: C:\Documents and Settings\A\...
- CreateNew: [Dropdown]

**Output Log:**

Date	Time	Message
Monday, November 10, ...	5:48:55 PM	Start Analog Input - Continuous execution
Monday, November 10, ...	5:49:05 PM	Stop Analog Input - Continuous execution
Monday, November 10, ...	5:50:09 PM	Start Analog Input - Continuous execution
Monday, November 10, ...	5:50:17 PM	Stop Analog Input - Continuous execution
Monday, November 10, ...	6:00:18 PM	Start Analog Input - Continuous execution
Monday, November 10, ...	6:00:33 PM	Stop Analog Input - Continuous execution

Monitor temperature measurements using the AMM interface.



## On the Bench and On the Go

### On the bench: Integration made easy

#### U2781A USB modular product chassis



The U2781A is a six-slot chassis for Keysight USB modular instruments and data acquisition devices. It offers the convenience of one AC-power connection and a single USB link. Modules are hot-swappable and the auto-detection feature reduces setup time and effort. This 4U-high chassis also provides simultaneous synchronization between modules and enables SSI/star-trigger bus synchronization with an external trigger source.

- Six USB module slots
- System Synchronous Interface (SSI)
- Star trigger and trigger-in/trigger-out signals
- Internal and external 10 MHz reference clock
- SCPI and IVI-COM compatibility

The U2781A modular chassis allows expansion up to 384 channels when slotted with the U2300A Series DAQ devices, providing a high-density data acquisition solution. The optional rackmount kit simplifies integration into a test system. The chassis' master/slave triggering capabilities also enable synchronization among various modules. This is possible even across modules with different functions (except for the switch matrix).

Its compact size saves space on the bench or in a rack. Hi-Speed USB 2.0 compatibility makes connection to a PC quick and easy.

For complete specifications of U2781A, please download the datasheet from [www.keysight.com/find/usbmodular](http://www.keysight.com/find/usbmodular)

### Accessories

The modular instrument chassis includes a USB extension cable. The table presents another accessory that may be useful.

Item	Model number
Rackmount kit	U2905A

### Dimensions (W x D x H)

270.00 x 271.20 x 197.00 mm (10.63 x 10.68 x 7.76 in)



U2905A, Rackmount Kit for U2700A Series USB DAQ Modular Instrument Chassis

## On the go: Essential accessories

When you're on the road, a few essential "survival kit" items may reduce weight and eliminate hassles. You should be able to find these at electronics stores (and some music stores) that carry computer accessories and power adapters.

### USB hub

Most laptop PCs have just two USB ports, and many people use one for a wireless mouse. To connect more than one USB modular instrument, you'll need a multiport USB 2.0 hub and an extra USB cable to connect the hub to your PC. Also, be sure that the hub is compatible with Windows XP Pro or Home (SP1 or later), or Windows 2000 Pro (SP4 or later).

### Multiport AC/DC adapter

Each USB modular instrument is powered by a 12 V, 2 A AC/DC adapter (12 V, 3 A for USB modular source/measure unit). To lighten the load on your shoulder, you may want to carry a Y-splitter or a multiport AC/DC adapter. The key specs for a suitable multiport adapter are 12 V/5 A for two USB MI and 12 V/8 A, for up to four USB MI. The DC connectors must be 9 mm long with a 5.5 mm outside diameter and 2.5 mm inside diameter.



## Software & Related Literature

### Refine your design—sooner

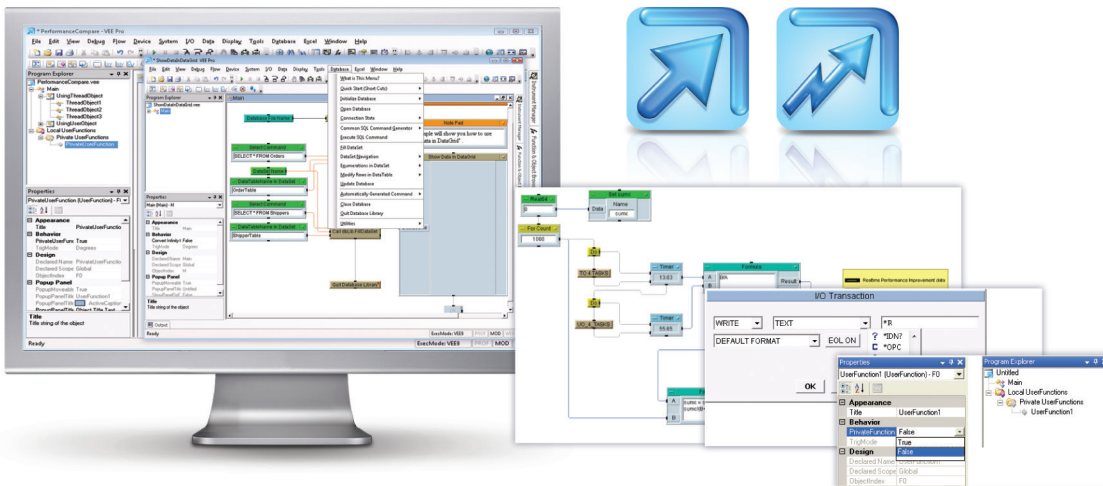
#### Keysight VEE Pro and VEE Express

Keysight VEE Pro 9.0 is intuitive graphical test & measurement software that provides a quick and easy path to measurement and analysis. It creates flexible, intuitive block diagrams for better instrument control and reduces test development time through greater efficiency.

Keysight VEE Pro lets you focus on your measurements rather than spending time on programming and connections. It keeps programming simple with a clean, clear development screen. Utilizing a familiar task-oriented flowchart look-and-feel, VEE Pro makes learning quick and easy so you can start making measurements in no time.

Keysight VEE Pro does even more to ensure productivity with other applications and languages by including embedded MATLAB functionality. With these capabilities, you can quickly gain new insights through advanced signal processing, mathematical analysis and data visualization.

Over the past 15 years, Keysight VEE Pro has helped thousands of scientists and engineers make better measurements—faster! Experience for yourself how Keysight VEE Pro simplifies test development—connect, measure, analyze, report—by trying it free for 30 days. You can download the evaluation software or request a CD at [www.keysight.com/find/vee](http://www.keysight.com/find/vee).



## Related Literature

A variety of DAQ- and MI-related application notes can be downloaded from [www.keysight.com](http://www.keysight.com).

<b>Digital I/O</b>	<b>Publication Number</b>
<i>Automated Handler Machine for Test System Using Keysight's U2100A DIO</i>	5989-7420EN
<i>Power Management Unit Troubleshooting with U2531A Simultaneous DAQ</i>	5989-7422EN
<i>Backlight Panel Display Surface Brightness and Color Testing with DAQ</i>	5989-7428EN
<i>Creating a Small, Low-cost RF Switching System Using a U2121A-based Solution</i>	5989-8069EN
<i>Small Engine Dynamometer Testing</i>	5989-8070EN
<i>Testing Electromagnetic Compatibility of Remote Keyless Entry Modules in Automotive Applications</i>	5989-8081EN
<i>Automotive Power Window Regulator Testing</i>	5989-7805EN
<i>DVD Player Manufacturing Test Using Keysight Modular Instruments</i>	5989-9566EN
<i>Testing Battery Chargers with the U2722A USB Modular Source Measure Unit</i>	5989-8547EN

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