

Keysight Technologies U2722A/U2723A USB Modular Source Measure Unit

Data Sheet



Features

- Four-quadrant operation (± 20 V, ± 120 mA)
- 100 pA measurement sensitivity with 16-bit resolution
- 0.1% basic accuracy
- Embedded test script (for U2723A, details on Page 3)
- IV Curve application support (for U2723A, on KMM and BenchVue)
- Hi-Speed USB 2.0 connectivity
- Dual-play operation: standalone and modular capability
- Bundled with easy-to-use Keysight Measurement Manager (KMM) software
- NEW! Control, automate and simplify with Keysight BenchVue software
- Compatible with a wide range of Keysight Development Environments (KDEs)

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 Technologies, Inc.'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.



Keysight U2722/3A USB Modular Source Measure Unit (SMU)

The U2722A and U2723A are 3-channel SMUs, the size of a typical novel, and flexibly operate as standalone units or as modular units in the U2781A USB modular product chassis. Each SMU provides voltage and current programming/readback with high-accuracy measurement capabilities. Each of the three channels may be configured separately or in a matrix – in series or parallel. These versatile SMUs allow you to perform sweep and measurement with just a single device, without extra configurations.



U2722/3A used as a standalone instrument



U2722/3A used as a modular instrument



Keysight U2700A series USB Modular Instruments won Design News' Golden Mousetrap Award in the 2009 Best Products Category.



Keysight U2723A USB SourceMeasure Unit won the 20th Annual Electronic Design, Strategy, News (EDN) Innovation Award in the DC and Low-Frequency Test category.

Control, Automate and Simplify with BenchVue – No Programming Needed

Keysight BenchVue software for the PC eliminates many of the issues around bench testing. By making it simple to connect, control instruments, and automate test sequences, you can quickly move past the test development phase and access results faster than ever before with just a few clicks. BenchVue supports hundreds of Keysight instrument types and models all from one easy to use application. Control, Automate, Simplify with BenchVue.

Increase the efficiency of your tests

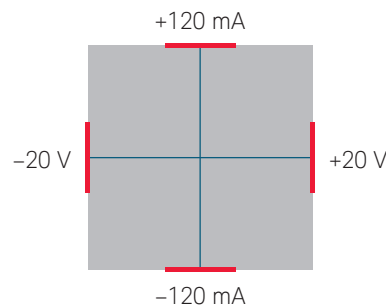
With a high measurement sensitivity of 100 pA at 16-bit resolution for pico-level measurement and 0.1% accuracy, the U2722A/U2723A USB Modular Source Measure Unit provides detailed and accurate analysis and measurement results. The U2722A/U2723A supports SCPI and IVI-COM, and is compatible with a wide range of Keysight Development Environments. Both choices of application software, the Keysight Measurement Manager (KMM) software and BenchVue USB Modular SMU App, help kickstart and simplify your SMU measurements.

Pre-define test configurations and execute commands automatically

The U2723A USB Modular SMU provides an embedded test script to help you pre-define test configurations or duplicate tests easily without spending too much time on programming. Each channel in the U2723A is allocated two memory lists, each capable of storing up to 200 commands and results individually. Stored commands in active memory will be executed accordingly while the measurement results obtained are automatically stored in the result buffer.

Four-quadrant operations with high measurement sensitivity and accuracy

The U2722A/U2723A SMU is a versatile device that allows you to perform sweep and measurement from different operating regions without needing extra configurations. The four-quadrant operation (± 20 V, ± 120 mA) makes the U2722A/U2723A SMU well suited for a wide range of test applications, including leakage measurement, solar cell measurement, forward/reverse voltage and curve tracer transistors. The U2722A/U2723A SMU also offers high measurement sensitivity with 16-bit resolution and accuracy that allows you to obtain more accurate analysis and measurement results.

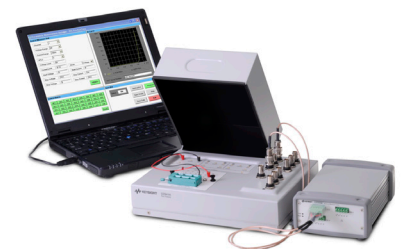


Fixture and upgraded software for semiconductor testing

The Keysight U2941A Parametric Test Fixture is designed to complement usage of the Keysight U2722A/U2723A USB Modular SMU in the testing of pin-through-hole semiconductor components, including SMT and DIP ICs. The U2941A comes with three input channels, a common ground, and five types of socket modules of various pin configurations.

The included Parametric Measurement Manager software allows easy set-up of the U2722A/U2723A and U2941A for parametric test, simplifies testing and enables recording of data. The software also supports the U2751A USB Modular Switch Matrix when used with the U2722A/U2723A SMU.

A purchasable upgraded software, the Keysight Parametric Measurement Manager Pro (U2942A), analyzes discrete semiconductor and plots the results in an IV curve. See page 9 for more information on the PMM Pro software.

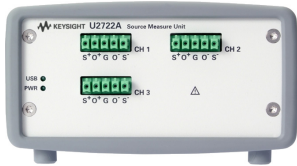


Download specifications for the U2941A Parametric Test Fixture from www.keysight.com/find/U2941A.

U2722A/U2723A USB Modular Source Measure Unit

Product outlook and dimensions

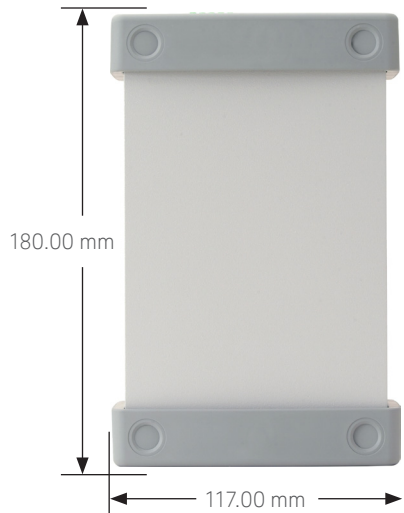
Front view



Rear view



Top view



Product characteristics and general specifications

Remote interface	<ul style="list-style-type: none"> – Hi-Speed USB 2.0 – USBTMC-USB4881
Power consumption	<ul style="list-style-type: none"> – +12 VDC, 3 A maximum – Isolated ELV supply source
Operating environment	<ul style="list-style-type: none"> – Operating temperature from 0 °C to +50 °C – Relative humidity at 20% to 85% RH (non-condensing) – Altitude up to 2000 meters – Pollution Degree 2 – For indoor use only
Storage compliance	–20 °C to 70 °C
Safety compliance	Certified with: <ul style="list-style-type: none"> – IEC 61010-1:2001/EN 61010-1:2001 (2nd Edition) – USA: ANSI/UL 61010-1:2004 – Canada: CSA C22.2 No.61010-1:2004
EMC compliance	<ul style="list-style-type: none"> – IEC 61326-1:2005/EN61326-1:2006 – Canada: ICES-001:2004 – Australia/New Zealand: AS/NZS CISPR 11:2004
Shock and vibration	Tested to IEC/EN 60068-2
IO connector	Output connectors
Dimension (W × D × H)	Module dimension: <ul style="list-style-type: none"> – 120.00 mm x 183.00 mm x 66.00 mm (with bumpers) – 105.00 mm x 175.00 mm x 50.00 mm (without bumpers)
Weight	Module dimension: <ul style="list-style-type: none"> – 700 g (with bumpers) – 650 g (without bumpers)
Warranty	One year for U2722A/U2723A Three months for standard shipped accessories

1. Compatible with Microsoft Windows operating systems only. Requires a direct USB connection to the PC so the appropriate driver can be installed in the USB modular instrument.

Standard shipped accessories

- 12 V, 3 A AC/DC Power adapter
- Power cord
- Plug-in connectors and cable casing
- USB Standard-A to Mini-B interface cable
- L-Mount kit (used with modular product chassis)
- Quick Start Guide
- Keysight Measurement Manager Quick Reference Card
- Reference CD-ROM
- Keysight Automation-Ready CD-ROM (contains the Keysight IO Libraries Suite)
- Certificate of Calibration

Product Specifications

Model	U2722A/U2723A
Number of outputs	3

Output ratings (at 0 °C to 50 °C)	
Voltage	-20 V to 20 V
Current	-120 mA to 120 mA

Performance specification			
U2722A/U2723A	Range	Accuracy ¹	Resolution
Voltage programming	±2 V	0.075% + 1.5 mV	0.1 mV
12 months (at 25 °C ± 3 °C), ± (% of output + offset)	±20 V	0.05% + 10 mV	1 mV
Current programming	±1 µA	0.085% + 0.85 nA	100 pA
12 months (at 25 °C ± 3 °C), ± (% of output + offset)	±10 µA	0.085% + 8.5 nA	1 nA
	±100 µA	0.075% + 75 nA	10 nA
	±1 mA	0.075% + 750 nA	100 nA
	±10 mA	0.075% + 7.5 µA	1 µA
	±120 mA	0.1% + 100 µA	20 µA
Voltage readback	±2 V	0.075% + 1.5 mV	0.1 mV
12 months (over USB with respect to the actual output at 25 °C ± 3 °C), ± (% of output + offset)	±20 V	0.05% + 10 mV	1 mV
Current readback	±1 µA	0.085% + 0.85 nA	100 pA
12 months (over USB with respect to the actual output at 25 °C ± 3 °C), ± (% of output + offset)	±10 µA	0.085% + 8.5 nA	1 nA
	±100 µA	0.075% + 75 nA	10 nA
	±1 mA	0.075% + 750 nA	100 nA
	±10 mA	0.075% + 7.5 µA	1 µA
	±120 mA	0.1% + 100 µA	20 µA

1. Accuracy measurements are based on NPLC 10.

Product Specifications (continued)

Performance characteristics			
Rise/fall time (ms) ¹		U2722A	U2723A
For resistive measurement ²	±1 µA	170.0	15.0
	±10 µA	18.0	5.0
	±100 µA	6.0	1.0
	±1 mA	1.0	1.0
	±10 mA	1.0	1.0
	±120 mA	1.0	1.0

Remote sense operating range	Ensure that the maximum voltage between the OUTPUT+ and SENSE+, OUTPUT-, and SENSE- does not exceed 3 V
Temperature coefficient	Maximum change in output/readback per °C after a 30-minute warm-up is 0.15
Guard output resistance	0.2 kΩ
Noise 10 Hz to 20 MHz (peak-peak)	100 mV typical into a resistive load (floating mode)
Output voltage overshoot, ±(% of output + offset) ²	During turn-on or turn-off, the output plus overshoot < 0.1% + 10 mV
Programming language	SCPI (Standard Commands for Programmable Instruments)
Maximum sense lead resistance	1 MΩ for rated accuracy
Voltage line regulation	0.01% of range
Voltage load regulation	0.01% + 100 µV
Current line regulation	0.04% of range
Current load regulation	0.04% + 100 µA
Recommended calibration interval	One year
Maximum input capacitance load	10 nF

1. Drive 50% of 1 V or 10 V output with a resistive load. Rise time is from 10% to 90% of program voltage change at maximum current. Fall time is from 90% to 10% of program voltage change at maximum current.
2. Measurements obtained are per default bandwidth setting.

NOTE

- All channels are isolated from the ground and from each other. Isolation is +60 VDC, Category 1.
- All specifications are based on a three-hour warm-up time.
- The measurement accuracy value is $x(1 + a * y)$, where,
 - x = accuracy specification at room temperature,
 - a = temperature coefficient, and
 - y = temperature change from room temperature in °C

Voltage range	Noise 10 Hz to 20 MHz (Peak-peak)					
	Current range					
	1 µA	10 µA	100 µA	1 mA	10 mA	120 mA
2 V	50 mV	50 mV	50 mV	50 mV	30 mV	30 mV
20 V	50 mV	50 mV	50 mV	50 mV	30 mV	30 mV

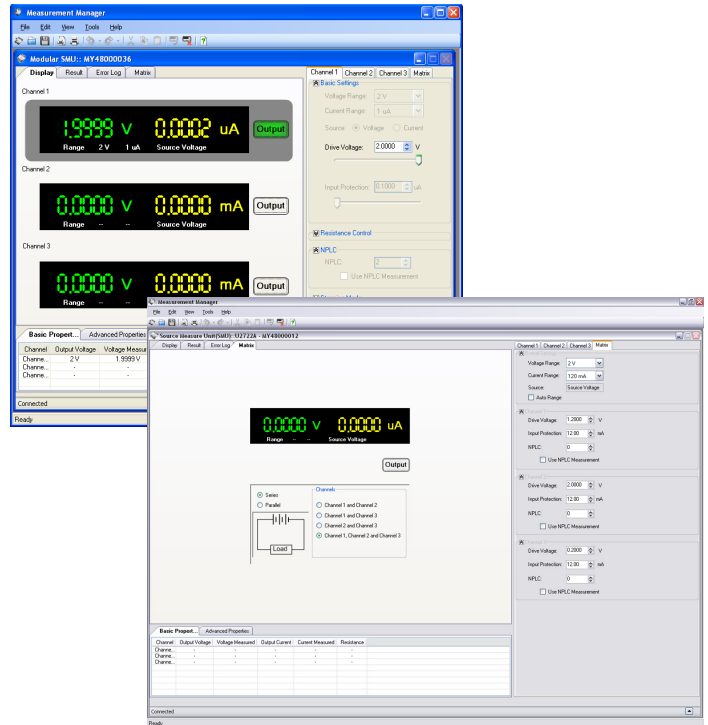
Keysight Measurement Manager

The Keysight Measurement Manager (KMM) is an application data viewer software that comes with the standard purchase of the U2700A Series USB modular instruments. This software is designed to help you perform quick device configuration, data logging and data acquisition with the modular instruments.

Supported features found in the U2722A/U2723A USB modular source unit::

- Command Logger and Code Converter
- Self-test
- Self-calibration
- Option to save the current instrument configuration to a file
- Data logging and export feature to CSV, HTML and text only format files that can be printed
- Trigger settings between modules in the instrument chassis with Star trigger and Master/Slave trigger

Prior to installing the Keysight Measurement Manager software, ensure that your PC meets the following minimum system requirements for installation and operation.



Requirement	Windows XP operating systems	Windows Vista operating systems	Windows 7 operating systems
Operating system	Windows XP Service Pack 3 (or later) ¹	Windows Vista (32-bit) Service Pack 1 and 2 ²	Windows 7 (32-bit and 64-bit) ^{3,4}
Processor speed	600 MHz or higher required, 800 MHz recommended	1 GHz 32-bit (x86)	3 GHz 32-bit (x86)
Memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum	2 GB minimum
Hard-disk space	1.5 GB minimum	1.5 GB minimum	1.5 GB minimum
Video	Super VGA (800 × 600) 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended ⁵	Support for DirectX 9 graphics with 128 MB graphics memory recommended ⁵
CD-ROM drive or DVD-ROM drive ⁶	Required	Required	Required
Browser	Microsoft Internet Explorer 5.01 or greater	Microsoft Internet Explorer 7 or greater	Microsoft Internet Explorer 7 or greater

1. Supported Windows XP editions – Home or Professional
2. Supported Windows Vista (32-bit) editions – Home Basic, Home Premium, Business, or Ultimate
3. Supported Windows 7 (32-bit and 64-bit) editions – Home Basic, Home Premium, Professional, Enterprise, or Ultimate
4. Keysight Measurement Manger for Windows 7 64-bit support is a 32-bit application running on a WOW64 (Windows-on-Windows 64-bit) emulator.
5. Super VGA graphics is supported for Windows Vista and Windows 7.
6. The type of media provided with the product determines whether a CD-ROM drive or DVD-ROM drive is required.

Software requirements

Keysight IO Libraries Suite 15.1 and above¹

Keysight T&M Toolkit Runtime version 2.1²

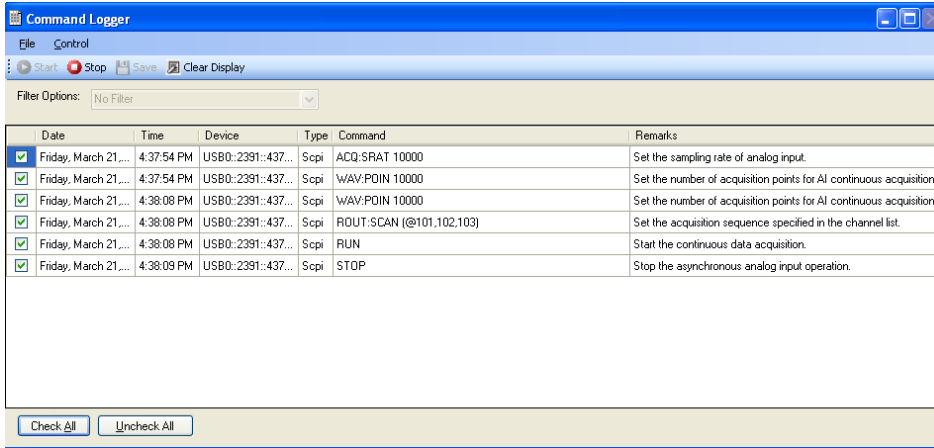
Keysight T&M Toolkit Redistributable Package 2.1 patch²

Microsoft .NET Framework version 2.0²

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

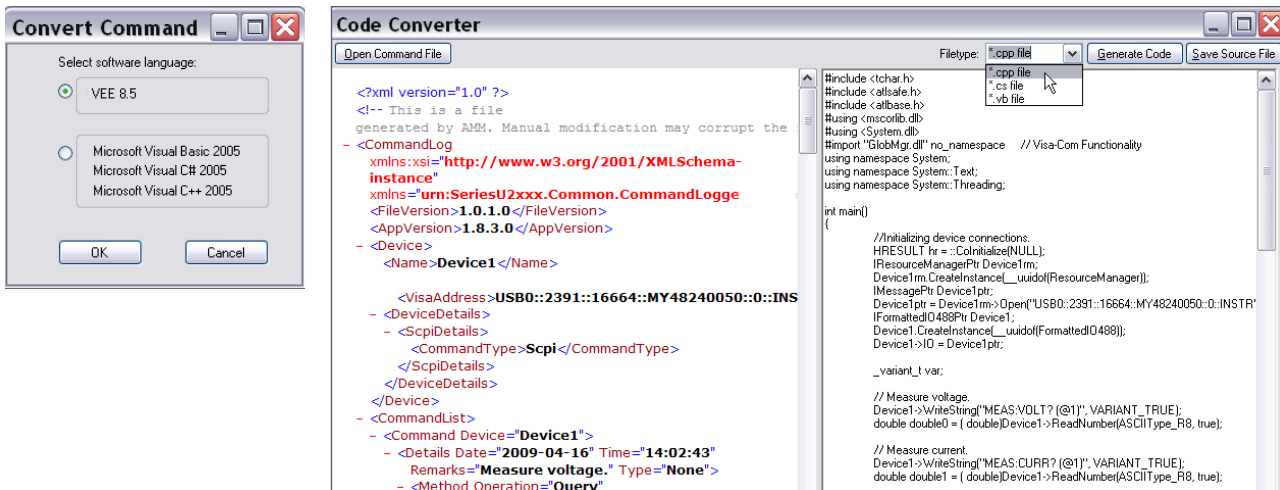
Command logger

The Command Logger function allows users to log SCPI or IVI-COM command sequences used to control your Keysight USB modular product. The function also captures the time each command is executed. Review the configuration commands at your own pace, or convert the commands to other programming languages with the KMM's Code Converter.



Code converter

KMM Code Converter comes with two converters: the Keysight VEE Code Converter, and the Microsoft C#/C++/VB Code Converter, allowing you to convert logged SCPI/IVI-COM commands to snippets of VEE Pro, Visual Basic, C++ and C# codes. You can now convert SCPI commands without needing advanced programming skills, helping you program with ease and allowing you to integrate your programs seamlessly for automated tests.



Keysight Parametric Measurement Manager Pro Software (U2942A)

Measure and analyze with ease

Keysight Parametric Measurement Manager Pro (PMM Pro) is a VEE-based software designed to perform basic semiconductor testing. The software specializes in the analysis of discrete semiconductor devices such as diodes, bipolar junction transistors and field effect transistors.

Designed for use with the U2722A/U2723A USB SMU and U2941A Parametric Test Fixture, Keysight PMM Pro controls the instruments to take parametric measurements such as voltage or current. The software then plots, displays and logs the results in an IV curve.

Keysight PMM Pro allows users to carry out measurements and display results without the need for prior programming experience. The software operates through an intuitive user-interface that is easy to understand and configure, and includes test sequence automation to further ease your task.

The U2722P and the U2723P Parametric Measurement Solution bundle consists of a Keysight USB SMU and the Keysight PMM Pro (U2942A). The U2722P and U2723P are available only in Europe and Asia (excluding Japan).

Features

- Intuitive GUI that is easy to configure and which simplifies testing
- Predefined test profiles for diode, bipolar junction transistors and field effect transistors
- Allows users to define and configure test profiles
- Automates test sequencing for parametric analysis
- Plots, displays and logs parametric measurements in an IV curve
- Built-in math functions such as addition, subtraction and division for quick analysis of results



Figure 1. Intuitive GUI that features both pre-defined and user-defined test profile.

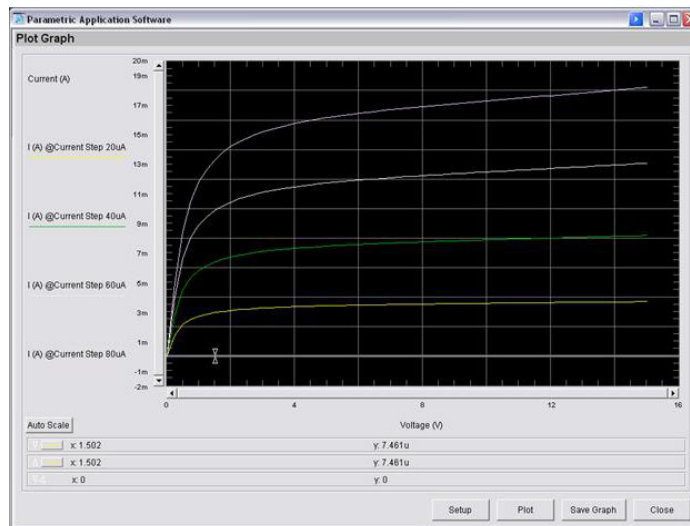


Figure 2. Plots, displays and logs parametric measurements in an IV curve.

Keysight Parametric Measurement Manager Pro Software (U2942A) (continued)

Minimum system requirements for PMM Pro

System requirements		
Operating system	Microsoft Windows XP SP3 or higher	<ul style="list-style-type: none"> – Microsoft Windows 7 (Professional, Ultimate, Enterprise) – Microsoft Windows Vista SP1 (Business, Ultimate, Enterprise) or higher
Architecture	x86 (32-bit), 64-bit for Windows 7 supportability ¹	
Prerequisite	<ul style="list-style-type: none"> – Keysight IO Libraries Suite 15.0 or higher² – Keysight VEE Pro 9.0 or higher (Runtime version)³ – Microsoft.NET Framework version 1.1 and 2.03 	
Processor	<ul style="list-style-type: none"> – 450 MHz Pentium II or higher required – 800 MHz recommended 	– 1 GHz required, 2 GHz recommended
Available memory	<ul style="list-style-type: none"> – 128 MB minimum – 256 MB or higher recommended 	– 1 GB minimum, 2 GB recommended
Available disk space	1 GB hard disk free space	
Video	Super VGA (800x600) display or higher resolution monitor with 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 6.0 or higher	Microsoft Internet Explorer 7 or higher

1. 32-bit application running on WOW64 (Windows-on-Windows) emulator.
2. Available on the Keysight Automation-Ready CD-ROM.
3. Bundled with the Keysight SMU PMM Pro software installer.

USB Modular SMU App within BenchVue

BenchVue software for the PC makes it simple to connect, control, capture and view multiple Keysight instruments simultaneously with no additional programming. You can derive answers faster than ever by easily viewing, logging and exporting measurement data and screen images with a few clicks from a single environment.

- Visualize multiple measurements simultaneously
- Easily log data, screen shots and system state
- Rapidly prototype custom test sequences
- Recall past states of your USB Modular to replicate results
- Export measurement data in the desired format fast
- Quickly access manuals, drivers, FAQs and videos

The USB Modular SMU App within BenchVue allows you to quickly control the U2722A/U2723A SMU to visualize measurements, perform data logging and annotate captured data. With BenchVue, you can visualize multiple SMU channels simultaneously, in addition to performing the following:

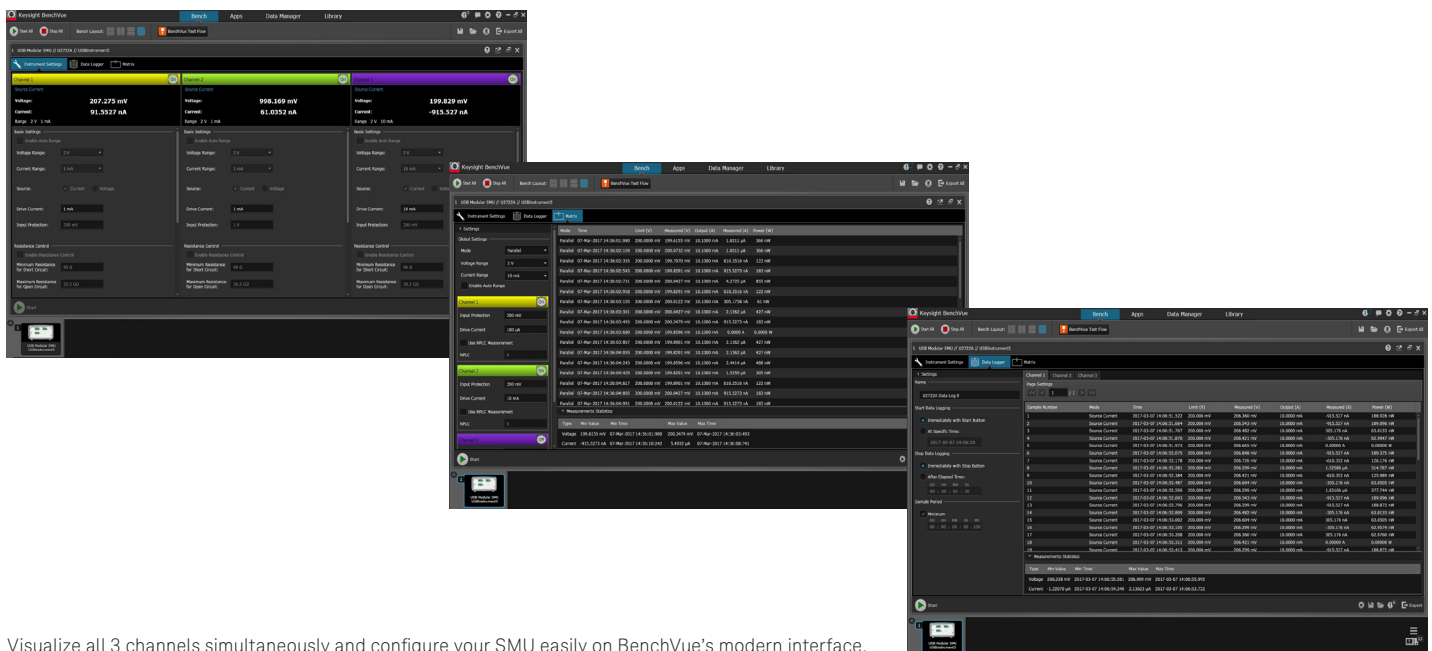
- Configure SMU channels – in serial or parallel – to achieve higher throughput
- Configure voltage and current source, range and limit for each channel
- Display source and measure concurrently for each channel
- Plot IV Curve (with U2723A)

In just a few clicks, you can also record measurements and export results to popular PC-friendly applications such as Microsoft Excel and Microsoft Word for further analysis. Upgrading to the Pro version (BV0023A) will provide you with unrestricted data logging with limit checking and alerts.

Get started with BenchVue, downloadable at no cost at www.keysight.com/find/benchvue.



View measurements across USB DAQ, modular and bench instruments all on one BenchVue interface.



Visualize all 3 channels simultaneously and configure your SMU easily on BenchVue's modern interface.

Ordering Information

U2722A	USB modular source measure unit
U2723A	USB modular source measure unit with embedded test scripts
U2941A	Parametric test fixture, shipped with: <ul style="list-style-type: none"> – Assembly PTFE plate – 28-pin dual-in-line package (DIP) socket module – 0.1-inch universal socket module – 0.075-inch universal socket module – 0.05-inch universal socket module – Pin plug-to-pin plug cables, black (4 pcs) – Pin plug-to-pin plug cables, red (4 pcs) – Pin plug-to-pin plug cables, blue (4 pcs) – Pin plug-to-miniature clip cables, black (4 pcs) – Pin plug-to-miniature clip cables, red (4 pcs) – Pin plug-to-miniature clip cables, blue (4 pcs) – PCB jumper pin – BNC to two-wire cable, 1 m (3 pcs) – Keysight Parametric Measurement Manager CD (includes installation and operation guide)
U2942A	Parametric Measurement Manager Pro software
U2722P*	U2722A USB modular source measure unit and U2942A Parametric Measurement Manager Pro bundle
U2723P*	U2723A USB modular source measure unit and U2942A Parametric Measurement Manager Pro bundle

1. Only available in Europe and Asia (excluding Japan)

Optional accessories for the U2700 Series

U2921A-101	USB secure cable, 2 m
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Optional accessories for the U2941A parametric test fixture

U2941A-101	Pin plug-to-pin plug cable, black
U2941A-102	Pin plug-to-pin plug cable, red
U2941A-103	Pin plug-to-pin plug cable, blue
U2941A-104	Pin plug-to-miniature clip cables, black
U2941A-105	Pin plug-to-miniature clip cables, red
U2941A-106	Pin plug-to-miniature clip cables, blue
U2941A-107	BNC to two-wire, 1 m
U2941A-201	Assembly PTFE plate <ul style="list-style-type: none"> – Insulation board with minimal leakage current; suitable for extremely low-current measurement
U2941A-202	28-pin dual-in-line package (DIP) socket module <ul style="list-style-type: none"> – Lever actuated zero insertion force (ZIF) socket
U2941A-203	0.1-inch universal socket module <ul style="list-style-type: none"> – 0.1-inch pitch; suitable for virtually any device such as components, DIP IC or small scale circuit
U2941A-204	0.075-inch universal socket module <ul style="list-style-type: none"> – 0.075-inch pitch; suitable for virtually any device such as components, DIP IC or small scale circuit
U2941A-205	0.05-inch universal socket module <ul style="list-style-type: none"> – 0.05-inch pitch; suitable for any device such as components, DIP IC or small scale circuit

Other products in the Keysight USB Modular Test Instruments Family



U2701A/U27012A USB Modular Oscilloscope

Features

- High sampling rate up to 500 MSa/s, enabling accurate measurement analysis
- Up to 32 MB large memory
- Fast fourier transfer (FFT) and waveform math functions enables easy waveform calculation

For more information: www.keysight.com/find/usbscope.



U2741A USB Modular Digital Multimeter (DMM)

Features

- Fast reading speed (up to 100 Sa/s)
- Wide range of basic measurement functions, including frequency and temperature measurements

For more information: www.keysight.com/find/U2741A.



U2751A USB Modular Switch Matrix

Features

- Minimal cross-talk of -30 dB at 45 MHz wide bandwidth
- High bandwidth at 45 MHz without terminal block
- Capability to test up to four devices-under-test (DUTs)
- Works with other Keysight instruments for multi-point testing

For more information: www.keysight.com/find/U2751A.



U2761A USB Modular Function/Arbitrary Waveform Generator

Features

- Direct digital synthesis (DDS) waveform generator
- Pulse generator that can generate pulse signal as stimulus
- Easy customization with Arbitrary Waveform Editor
- Internal modulation capability simplifies test setup

For more information: www.keysight.com/find/U2761A.



U2781A USB Modular Product Chassis

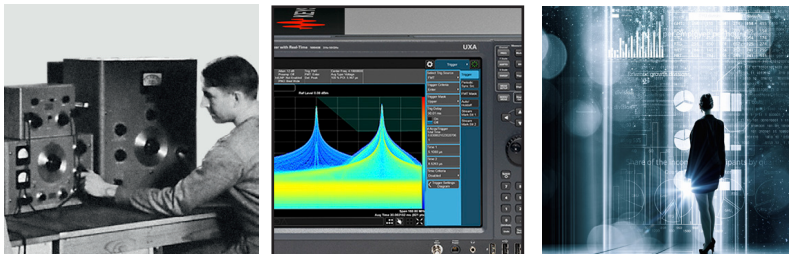
Features

- Expansion of channels for each modular product
- Multiple instrument synchronization
- Internal and external 10 MHz reference clock
- High-speed USB 2.0
- SSI/Star trigger bus synchronization between external trigger source and modules

For more information: www.keysight.com/find/U2781A.

Evolving

Our unique combination of hardware, software, support, and people can help you reach your next breakthrough. **We are unlocking the future of technology.**



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Our deep offering in design, test, and measurement services deploys an industry-leading array of people, processes, and tools. The result? We help you implement new technologies and engineer improved processes that lower costs.



Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's committed to superior product quality and lower total cost of ownership. Keysight is the only test and measurement company with three-year warranty standard on all instruments, worldwide. And, we provide a one-year warranty on many accessories, calibration devices, systems and custom products.



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/U2722A

www.keysight.com/find/U2723A

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

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United States	(800) 829 4444

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Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

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France	0805 980333
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Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
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