

Keysight E5260A

8 Slot High speed Measurement Mainframe

Technical Overview





Introduction

The Keysight Technologies, Inc. E5260A 8 Slot high speed measurement mainframe is completely user-configurable. You can install up to eight single-slot modules (such as the MPSMU), up to four dual-slot modules (such as the HPSMU), or any physically allowable combination thereof.

Basic features

- Performs high-speed, dc parametric measurements
- Eight slots for plug-in modules
- User interface allows spot measurements to be made from the front panel
- High-speed ADC present on each installed SMU
- Ground unit up to 4 A
- BNC trigger-in and trigger-out connectors
- 16 general-purpose digital I/Os
- Program memory
- GPIB port for instrument control
- Self-test, self-calibration, diagnostics

Measurement modes

The Keysight E5260A supports the following measurement modes:

- Spot
- Pulsed spot
- Quasi-pulsed spot
- Staircase sweep
- Multi-channel sweep
- Pulsed sweep
- Staircase sweep with pulsed bias
- Linear search
- Binary search

Hardware

Specification conditions

The measurement and output accuracy are specified at the module connector terminals when referenced to the Zero Check terminal under the following conditions:

1. Temperature: $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$
(double for 5°C to 18°C , and 28°C to 40°C if not noted otherwise)
2. After 40 minutes warm-up
3. Ambient temperature change less than $\pm 1^{\circ}\text{C}$ after auto calibration execution
4. Measurement made within one hour after auto calibration execution
5. Averaging (high-speed per-SMU ADC): 128 samples in 1 PLC; Integration time
6. Filter: ON (for SMUs)
7. Kelvin connection
8. Calibration period: 1 year

Note: This document lists specifications and supplemental information for the E5260A and its associated modules. The specifications are the standards against which the E5260A and its associated modules are tested. When the E5260A or any of its associated modules are shipped from the factory, they meet the specifications. The “supplemental” information and “typical” entries in the following specifications are not warranted, but provide useful information about the functions and performance of the instrument.

E5260A Mainframe Specification

Supported plug-In modules

The E5260A supports eight slots for plug-in modules.

Part number	Description	Slots occupied	Range of operation	Minimum resolution
E5290A	High speed HPSMU	2	-200 V to 200 V, -1 A to 1 A	100 μV , 5 μA
E5291A	High speed MPSMU	1	-100 V to 100 V, -200 mA to 200 mA	100 μV , 5 μA

Maximum output power

The total module power consumption cannot exceed 80 W.

Note: Using the HPSMU and MPSMU units, it is impossible to create a combination that exceeds the 80-watt limit.

Maximum voltage between common and ground

Maximum common to ground voltage must be $\pm 42\text{ V}$

Pulse measurement

Pulse width: 500 μs to 2 s
 Pulse period: 5 ms to 5 s
 Period \geq width + 2 ms
 (when width \leq 100 ms)
 Period \geq width + 10 ms
 (when width $>$ 100 ms)
 Pulse resolution: 100 μs

Ground unit (GNDU) specification

The GNDU is furnished with the E5260A mainframe.

Output voltage: $0\text{ V} \pm 100\ \mu\text{V}$
 Maximum sink current: 4 A
 Output terminal/connection:
 Triaxial connector, Kelvin (remote sensing)

GNDU supplemental information

Load capacitance: 1 μF

Cable resistance:
 For $I_s \leq 1.6\text{ A}$:
 Force line $R < 1\ \Omega$
 For $1.6\text{ A} < I_s \leq 2.0\text{ A}$:
 Force line $R < 0.7\ \Omega$
 For $2.0\text{ A} < I_s \leq 4.0\text{ A}$:
 Force line $R < 0.35\ \Omega$
 For all cases:
 Sense line $R \leq 10\ \Omega$

Where I_s is the current being sunk by the GNDU.

MPSMU (Medium Power SMU) Module Specifications

Voltage range, resolution, and accuracy (MPSMU)

Voltage range	Force resolution	Measure resolution	Force accuracy ¹	Measure accuracy ¹	Maximum current
±2 V	100 µV	100 µV	±(0.03 % + 900 µV)	±(0.03 % + 700 µV)	200 mA
±20 V	1 mV	1 mV	±(0.03 % + 4 mV)	±(0.03 % + 4 mV)	200 mA
±40 V	2 mV	2 mV	±(0.03 % + 7 mV)	±(0.03 % + 8 mV)	²
±100 V	5 mV	5 mV	±(0.04 % + 15 mV)	±(0.03 % + 20 mV)	³

- ± (% of output/measured value + offset voltage)
- 200 mA ($V_o \leq 20$ V), 50 mA (20 V < $V_o \leq 40$ V), V_o is the output voltage in volts.
- 200 mA ($V_o \leq 20$ V), 50 mA (20 V < $V_o \leq 40$ V), 20 mA (40 V < $V_o \leq 100$ V), V_o is the output voltage in volts.

Current range, resolution, and accuracy (MPSMU)

Current range	Force resolution	Measure resolution ⁴	Force accuracy ¹	Measure accuracy ^{1,2}	Maximum voltage
±100 nA	5 pA	5 pA	±(0.12 % + 50 pA + 5 pA x ($V_o/25$))	±(0.1 % + 30 pA + 5 pA x ($V_o/25$))	100 V
±1 µA	50 pA	50 pA	±(0.12 % + 400 pA + 50 pA x ($V_o/25$))	±(0.1 % + 200 pA + 50 pA x ($V_o/25$))	100 V
±10 µA	500 pA	500 pA	±(0.12 % + 5 nA + 500 pA x ($V_o/25$))	±(0.1 % + 3 nA + 500 pA x ($V_o/25$))	100 V
±100 µA	5 nA	5 nA	±(0.12 % + 40 nA + 5 nA x ($V_o/25$))	±(0.1 % + 20 nA + 5 nA x ($V_o/25$))	100 V
±1 mA	50 nA	50 nA	±(0.12 % + 500 nA + 50 nA x ($V_o/25$))	±(0.1 % + 300 nA + 50 nA x ($V_o/25$))	100 V
±10 mA	500 nA	500 nA	±(0.12 % + 4 µA + 500 nA x ($V_o/25$))	±(0.1 % + 2 µA + 500 nA x ($V_o/25$))	100 V
±100 mA	5 µA	5 µA	±(0.12 % + 50 µA + 5 µA x ($V_o/25$))	±(0.1 % + 30 µA + 5 µA x ($V_o/25$))	³
±200 mA	10 µA	10 µA	±(0.12 % + 100 µA + 10 µA x ($V_o/50$))	±(0.1 % + 60 µA + 10 µA x ($V_o/50$))	⁴

- ± (% of output/measured value + offset current A (fixed part determined by the output/measurement range + proportional part that is multiplied by V_o))
- 2Round up below decimal point for the value of ($V_o/25$) and ($V_o/50$)
- 100 V ($I_o \leq 20$ mA), 40 V (20 mA < $I_o \leq 50$ mA), 20 V (50 mA < $I_o \leq 100$ mA), I_o is the output current in amps.
- 100 V ($I_o \leq 20$ mA), 40 V (20 mA < $I_o \leq 50$ mA), 20 V (50 mA < $I_o \leq 200$ mA), I_o is the output current in amps.

Power consumption (MPSMU)

Voltage source mode:

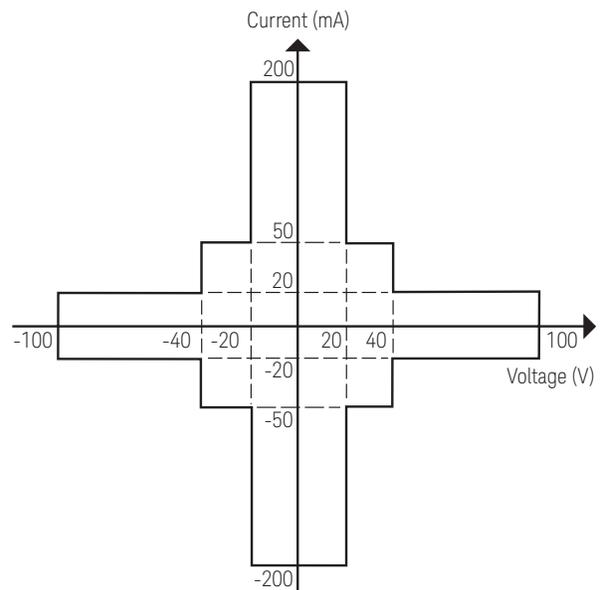
Voltage range	Power
2 V	20 x I_c (W)
20 V	20 x I_c (W)
40 V	40 x I_c (W)
100 V	100 x I_c (W)

Where I_c is the current compliance setting.

Current source mode:

Voltage compliance	Power
$V_c \leq 20$	20 x I_o (W)
$20 < V_c \leq 40$	40 x I_o (W)
$40 < V_c \leq 100$	100 x I_o (W)

Where V_c is the voltage compliance setting and I_o is output current.



MPSMU measurement and output range

Output terminal/connection:

Triaxial connector, Kelvin (remote sensing)

Voltage/current compliance (limiting)

The SMU can limit output voltage or current to prevent damaging the device under test.

Voltage: 0 V to ± 100 V

Current: ± 100 pA to ± 200 mA

Compliance accuracy: Same as the current (or voltage) set accuracy.

MPSMU supplemental information

Maximum allowable cable resistance (Kelvin connection):

Force Line: 10 Ω ($I \leq 100$ mA)

Force Line: 1.5 Ω (100 mA $< I \leq 200$ mA)

Sense Line: 10 Ω (All cases)

Voltage source output resistance: 0.3 Ω typical (Force line, non-Kelvin connection)

Voltage measurement input resistance: $\geq 10^{13}$ Ω

Current source output resistance: $\geq 10^{13}$ Ω (1 nA range)

Current compliance setting accuracy (for opposite polarity):

For 100 nA to 200 mA ranges: I setting accuracy ± 2.5 % of range

Maximum capacitive load:

For 100 nA to 10 mA ranges: 10 nF

For 100 mA to 200 mA ranges: 100 μ F

Maximum guard capacitance: 900 pF

Maximum shield capacitance: 5000 pF

Maximum guard offset voltage: ± 1 mV

Noise characteristics (typical, filter ON):

Voltage source: 0.01 % of V range (rms)

Current source: 0.1 % of I range (rms)

Overshoot (typical, filter ON):

Voltage source: 0.03 % of V range

Current source: 1 % of I range

Range switching transient noise (typical, filter ON):

Voltage ranging: 250 mV

Current ranging: 10 mV

Slew rate: 0.2 V/ μ s

SMU pulse setting accuracy (fixed measurement range):

Width: 0.5 % + 50 μ s

Period: 0.5 % + 100 μ s

Trigger out delay (pulsed measurements):

0 to 32.7 ms with 100 μ s resolution ($<$ pulse width)

HPSMU (High Power SMU) Module Specifications

Voltage range, resolution, and accuracy (HPSMU)

Voltage range	Force resolution	Measure resolution	Force accuracy ¹	Measure accuracy ¹	Maximum current
± 2 V	100 μ V	100 μ V	$\pm(0.03\% + 900 \mu\text{V})$	$\pm(0.03\% + 700 \mu\text{V})$	1 A
± 20 V	1 mV	1 mV	$\pm(0.03\% + 4 \text{ mV})$	$\pm(0.03\% + 4 \text{ mV})$	1 A
± 40 V	2 mV	2 mV	$\pm(0.03\% + 7 \text{ mV})$	$\pm(0.03\% + 8 \text{ mV})$	2
± 100 V	5 mV	5 mV	$\pm(0.04\% + 15 \text{ mV})$	$\pm(0.03\% + 20 \text{ mV})$	3
± 200 V	10 mV	10 mV	$\pm(0.045\% + 30 \text{ mV})$	$\pm(0.035\% + 40 \text{ mV})$	4

1. \pm (% of output/measured value + offset voltage V)

2. 1 A ($V_o \leq 20$ V), 500 mA (20 V $< V_o \leq 40$ V), V_o is the output voltage in volts.

3. 1 A ($V_o \leq 20$ V), 500 mA (20 V $< V_o \leq 40$ V), 125 mA (40 V $< V_o \leq 100$ V), V_o is the output voltage in volts.

4. 1 A ($V_o \leq 20$ V), 500 mA (20 V $< V_o \leq 40$ V), 125 mA (40 V $< V_o \leq 100$ V), 50 mA (100 V $< V_o \leq 200$ V), V_o is the output voltage in volts.

Current range, resolution, and accuracy (HPSMU)

Current range	Force resolution	Measure resolution	Force accuracy ^{1,2}	Measure accuracy ^{1,2}	Maximum voltage
± 100 nA	5 pA	5 pA	$\pm(0.12\% + 50 \text{ pA} + 5 \text{ pA} \times (V_o/25))$	$\pm(0.1\% + 30 \text{ pA} + 5 \text{ pA} \times (V_o/25))$	200 V
± 1 μ A	50 pA	50 pA	$\pm(0.12\% + 400 \text{ pA} + 50 \text{ pA} \times (V_o/25))$	$\pm(0.1\% + 200 \text{ pA} + 50 \text{ pA} \times (V_o/25))$	200 V
± 10 μ A	500 pA	500 pA	$\pm(0.12\% + 5 \text{ nA} + 500 \text{ pA} \times (V_o/25))$	$\pm(0.1\% + 3 \text{ nA} + 500 \text{ pA} \times (V_o/25))$	200 V
± 100 μ A	5 nA	5 nA	$\pm(0.12\% + 40 \text{ nA} + 5 \text{ nA} \times (V_o/25))$	$\pm(0.1\% + 20 \text{ nA} + 5 \text{ nA} \times (V_o/25))$	200 V
± 1 mA	50 nA	50 nA	$\pm(0.12\% + 500 \text{ nA} + 50 \text{ nA} \times (V_o/25))$	$\pm(0.1\% + 300 \text{ nA} + 50 \text{ nA} \times (V_o/25))$	200 V
± 10 mA	500 nA	500 nA	$\pm(0.12\% + 4 \mu\text{A} + 500 \text{ nA} \times (V_o/25))$	$\pm(0.1\% + 2 \mu\text{A} + 500 \text{ nA} \times (V_o/25))$	200 V
± 100 mA	5 μ A	5 μ A	$\pm(0.12\% + 50 \mu\text{A} + 5 \mu\text{A} \times (V_o/25))$	$\pm(0.1\% + 30 \mu\text{A} + 5 \mu\text{A} \times (V_o/25))$	3
± 1 A	50 μ A	50 μ A	$\pm(0.5\% + 500 \mu\text{A} + 50 \mu\text{A} \times (V_o/25))$	$\pm(0.5\% + 300 \mu\text{A} + 50 \mu\text{A} \times (V_o/25))$	4

1. \pm (% of output/measured value + offset current A (fixed part determined by the output/measurement range + proportional part that is multiplied by V_o))

2. Round up below decimal point for the value of ($V_o/25$).

3. 200 V ($I_o \leq 50$ mA), 100 V (50 mA $< I_o \leq 100$ mA)

4. 200 V ($I_o \leq 50$ mA), 100 V (50 mA $< I_o \leq 125$ mA), 40 V (125 mA $< I_o \leq 500$ mA), 20 V (500 mA $< I_o \leq 1$ A), I_o is the output current in amps.

Power consumption (HPSMU)

Voltage source mode:

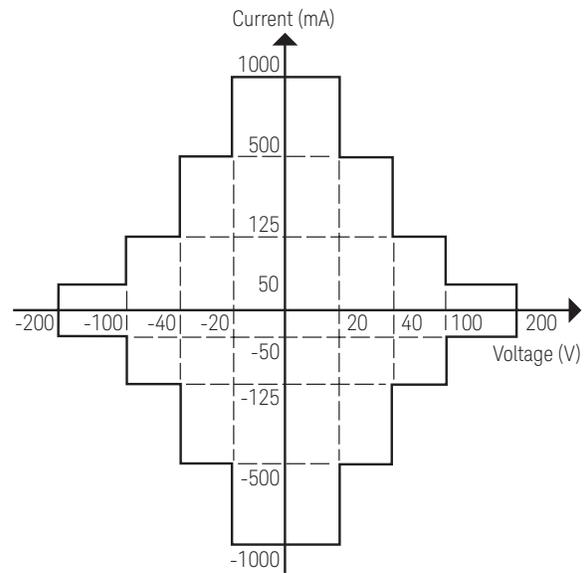
Voltage range	Power
2 V	20 x I _c (W)
20 V	20 x I _c (W)
40 V	40 x I _c (W)
100 V	100 x I _c (W)
200 V	200 x I _c (W)

Where I_c is the current compliance setting.

Current source mode:

Voltage compliance	Power
V _c ≤ 20	20 x I _o (W)
20 < V _c ≤ 40	40 x I _o (W)
40 < V _c ≤ 100	100 x I _o (W)
100 < V _c ≤ 200	200 x I _o (W)

Where V_c is the voltage compliance setting and I_o is output current.



HPSMU measurement and output range

Output terminal/connection:

Triaxial connector, Kelvin (remote sensing)

Voltage/current compliance(limiting)

The SMU can limit output voltage or current to prevent damaging the device under test.

Voltage: 0 V to ± 200 V

Current: ± 100 pA to ± 1 A

Compliance accuracy: Same as the current (or voltage) set accuracy.

HPSMU supplemental information

Maximum allowable cable resistance (Kelvin connection):

Force line: 10 Ω (I ≤ 100 mA)

Force line: 1.5 Ω (100 mA < I ≤ 1 A)

Sense line: 10 Ω (All cases)

Voltage source output resistance:

0.2 Ω typical (Force line, non-Kelvin connection)

Voltage measurement input resistance: ≥ 10¹³ Ω

Current source output resistance: ≥ 10¹³ Ω (1 nA range)

Current compliance setting accuracy (for opposite polarity):

For 1 nA to 10 nA ranges: I setting accuracy ± 12 % of range

For 100 nA to 1 A ranges: I setting accuracy ± 2.5 % of range

Maximum capacitive load:

For 100 nA to 10 mA ranges: 10 nF

For 100 mA to 1 A ranges: 100 μF

Maximum guard capacitance: 900 pF

Maximum shield capacitance: 5000 pF

Maximum guard offset voltage: ± 1 mV

Noise characteristics (typical, filter ON):

Voltage source: 0.01 % of V range (rms)

Current source: 0.1 % of I range (rms)

Overshoot (typical, filter ON):

Voltage source: 0.03 % of V range

Current source: 1 % of I range

Range switching transient noise (typical, filter ON):

Voltage ranging: 250 mV

Current ranging: 10 mV

Slew rate: 0.2 V/μs

SMU pulse setting accuracy (fixed measurement range):

Width: 0.5 % + 50 μs

Period: 0.5 % + 100 μs

Trigger out delay (pulsed measurements):

0 to 32.7 ms with 100 μs resolution (< pulse width)

Functions

Front panel operations

Display

- Display error messages
- Display spot measurement set value
- Display spot measurement result

Keypad operations

- Set GPIB address
- Set local/remote mode
- Select measurement channel
- Set spot measurement set value
- Start calibration/diagnostics

MPSMU and HPSMU Measurement Mode Details

Spot measurement mode

Outputs and measures voltage and current.

Staircase sweep measurement mode

Outputs swept voltage or current, and measures dc voltage or current. One channel can sweep current or voltage while up to eight channels can measure current or voltage. A second channel can be synchronized with the primary sweep channel as an additional voltage or current sweep source. Linear or log sweeps can be performed.

Number of steps: 1 – 1,001

Hold time: 0 – 655.35 s, 1 ms resolution

Delay time: 0 – 65.5350 s, 100 μ s resolution

Multi-channel sweep measurement mode

Outputs swept voltage or current, and measures dc voltage or current. Up to eight channels can sweep current or voltage and up to eight channels can measure current or voltage. Linear or log sweeps can be performed.

Number of steps: 1– 1,001

Hold time: 0 – 655.35 s, 1 ms resolution

Delay time: 0 – 65.5350 s, 100 μ s resolution

Pulsed spot measurement mode

Outputs a voltage or current pulse and measures dc voltage or current.

Pulse width: 500 μ s to 100 ms, 100 μ s resolution

Pulse period: 5 ms to 1 s (\geq pulse width + 4 ms), 100 μ s resolution

Maximum pulse duty: 50 %

Pulsed sweep measurement mode

Outputs pulsed swept voltage or current, and measures dc voltage or current. A second channel can be programmed to output a staircase sweep voltage or current synchronized with the pulsed sweep output.

Staircase sweep with pulsed bias measurement mode

Outputs swept voltage or current, and measures dc voltage or current. A second channel can be programmed to output a pulsed bias voltage or current. A third channel can be synchronized with the primary sweep channel as an additional voltage or current sweep source.

Quasi-pulsed spot measurement mode

Outputs quasi-pulsed voltage and measures dc voltage or current.

Linear search measurement mode

Outputs and measure voltage or current by using linear search method.

Binary search measurement mode

Outputs and measure voltage or current by using binary search method.

Time Stamp

The E5260A supports a time stamp function utilizing an internal quartz clock.

Resolution: 100 μ s

Program Memory

The E5260A mainframe contains (volatile) memory that can be used to increase test measurement throughput. Program memory allows the storage of program code in the E5260A, eliminating the need to communicate over the GPIB interface. In addition, input data can be passed to code sequences stored in program memory.

Maximum lines of storable code: 40,000

Maximum number of program sequences: 2,000

Output Data Buffer

The number of data points that can be stored in the data buffer varies with the choice of the output data format.

Minimum number of storable data Points: 34,034

Trigger I/O

Trigger in/out synchronization pulses before and after setting and measuring dc voltage and current. Arbitrary trigger events can be masked or activated independently.

Input

An external trigger input signal can be used to do any of the following:

1. Start a measurement
2. Start a measurement at each sweep step for a staircase sweep or multi channel sweep measurement
3. Start the source output at each sweep step for a staircase sweep, pulsed sweep, staircase sweep with pulsed bias, or multi-channel sweep measurement.
4. Start the pulsed output for a pulsed spot measurement.
5. Recover from a wait state.

Input level: TTL level, negative or positive edge trigger, or TTL level, negative or positive gate trigger.

Output

An output trigger signal can be sent when one of the following events occurs:

1. The end of a measurement is reached.
2. The end of a measurement at each sweep step for a staircase sweep or multi channel sweep measurement is reached.
3. Completion of the source output setup at each sweep step for a staircase sweep, pulsed sweep, staircase sweep with pulsed bias, or multi-channel sweep measurement.
4. Completion of the pulsed output setup for a pulsed spot measurement.
5. A trigger command is issued.

Output level: TTL level, negative or positive edge trigger, or TTL level, negative or positive gate trigger.

General Purpose Digital I/O

16 general-purpose digital I/O signals are available via a 25-pin DIN connector. These pins can be used as an alternative to the BNC trigger-in and trigger-out lines to synchronize the E5260A with other instruments. They can also be used as output and input ports for digital signals. The user can selectively assign pins to trigger mode or digital I/O mode.

Attached Software

A VXI *plug&play* driver is supplied.

Supported operating systems:

Microsoft Windows XP Professional (SP3), Windows Vista Business (SP2, 32 bit), Windows 7 Professional (SP1, 32 bit or 64 bit)

General Specifications

Temperature range

Operating: +5°C to +40°C
Storage: -20°C to +60°C

Humidity range

Operating: 15 % to 80 % RH, non-condensing
Storage: 5 % to 90 % RH, non-condensing

Altitude

Operating: 0 m to 2,000 m (6,561 ft)
Storage: 0 m to 4,600 m (15,092 ft)

Power requirement

ac voltage: 90 V to 264 V
Line frequency: 47 Hz to 63 Hz

Maximum volt-amps (VA)

E5260A: 600 VA

Regulatory compliance

EMC: IEC 61326-1:+A1/EN61326-1:+A1
AS/NZS 2064.1
Safety: CSA C22.2 No.1010.1-1992
IEC61010-1:+A2/EN61010-1:+A2
UL3111-1:1994

Certification

CE, CSA, NRTL/C, C-Tick

Dimensions

E5260A: 426 mm W x 235 mm H x 575 mm D

Weight

E5260A (empty): 17 kg
E5290A: 2.5 kg
E5291A: 1.4 kg

Furnished accessories

Software CD-ROM (including VXIplug&play driver)

Other Keysight Products

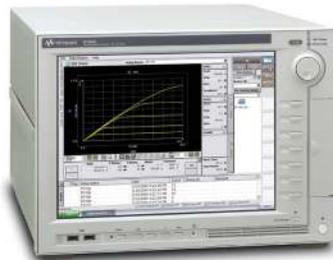
Keysight B2900A Series Precision
Source/Measure Unit
www.keysight.com/find/B2900A



Keysight B1500A Semiconductor
Device Analyzer
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Keysight B1505A Power Device
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Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



Keysight Assurance Plans

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www.keysight.com/go/quality

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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	1 800 112 929
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

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