Keysight E5262A
2 Channel IV Analyzer/Source Monitor Unit
(Two Medium Power SMUs)

Keysight E5263A
2 Channel IV Analyzer/Source Monitor Unit
(High Power SMU and Medium Power SMU)

Data Sheet

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Unlocking Measurement Insights

Introduction

Keysight Technologies, Inc. E5262A and E5263A 2ch IV Analyzers are the low cost solution for current-voltage characterization. The E5262A and E5263A support two channels of SMUs (Source/Monitor Units) for voltage/current sourcing and voltage/current measurement with the best in the class current measurement performance as low as 5 pA. The EasyEXPERT group+ GUI based characterization software is furnished and available on your PC to support all the tasks required in the characterization from the measurement setup to the data analysis. Powerful integration of SMU's versatile measurement capabilities and GUI based characterization software makes the E5262A and E5263A the best solutions for characterization and evaluation of two or three terminal devices such as materials and active/passive components with uncompromised measurement reliability and efficiency.

Keysight EasyEXPERT group+ supports efficient and repeatable device characterization in the entire characterization process from measurement setup and execution to analysis and data management either by interactive manual operation or automation across a wafer in conjunction with a semiautomatic wafer prober. EasyEXPERT group+ makes it easy to perform current-voltage characterization immediately with the intuitive GUI based operation, and allows you the option of storing test condition and measurement data automatically after each measurement in a unique built-in database (workspace), ensuring that valuable information is not lost and that measurements can be repeated at a later date. Keysight E5262A/E5263A provides the convenient low cost solution for current-voltage characterization with these versatile capabilities.

In addition to using as an analyzer, the E5262 and E5263A are available as a system component SMU for a rack and stuck test system. It provides the high throughput and expandability for current-voltage measurement at low cost. It can be controlled remotely by the FLEX command set supporting the powerful measurement capabilities.

Basic Features

Current–voltage measurement capabilities

– Accurate and precision measurement ranges.
  – E5262A: 5 pA – 200 mA/100 µV – 100 V
  – E5263A: 5 pA – 1 A/100 µV – 200 V
– Spot and sweep measurement capabilities
– Pulse spot and sweep measurement with minimum 500 µs pulse width

EasyEXPERT group+ software

– Characterization environment is available on user's PC
– Intuitive GUI based operation with keyboard and mouse operation
– Application Test mode provides the furnished ready-to-use application tests for quick measurement execution (Available application tests can be adapted to configured resources.)
– Classic test mode provides easy access to the instrument features
– Graphical display and analysis capabilities facilitate front-end data analysis without additional utilities and support report generation as image data or Excel data.
– Individualized built-in database (workspace) records test data automatically and simplifies the data management without annoying numerous data files.
– Quick test mode supports test sequencing without programming
– GUI-based control of the Keysight B2200A, B2201A and E5250A switching matrices
– EasyEXPERT remote control function supports the remote execution of application tests via the LAN interface
– Data back capability and various data protection feature for shared usage by multiple users
– EasyEXPERT group+ can be installed on as many PCs as you need without additional charge to take advantage of offline personal analyzer environment among users in your department.

E5262A/E5263A hardware

– Pre-fixed configuration of 2 channel SMUs
  – E5262A is configured with two Medium Power SMUs (MPSMUs).
  – E5263A is configured with a High Power SMU (HPSMU) and a Medium Power SMU (MPSMU).
– High-speed analog-to-digital converter (ADC) is available.
– Active ground unit (GNDU) in mainframe to force 0 V and sink the current up to 2.2 A
– Multiple interfaces (GPIB, trigger in/out and digital I/O)
– FLEX command set and program memory for remote control programming
– Self-test, self-calibration and diagnostics functions

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°C ± 5°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 ± 1°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 E5262A and E5263A and its associated modules. The specifications are the standards against which the E5262A and E5263A and its associated modules are tested. When the E5262A and E5263A 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.

E5262A and E5263A Mainframe Specification

The E5262A and E5263A are identical in form and function except for their SMU configuration.

The E5262A supports two high speed medium power SMUs (MPSMUs).

Description	Range of operation	Minimum resolution
High speed MPSMU	–100 V to 100 V, –200 mA to 200 mA	100 µV, 5 pA

The E5263A supports one high speed medium power SMU (MPSMUs) and one high speed high power SMU (HPSMU).

Description	Range of operation	Minimum resolution
High speed HPSMU	–200 V to 200 V, –1 A to 1 A	100 µV, 5 pA
High speed MPSMU	–100 V to 100 V, –200 mA to 200 mA	100 µV, 5 pA

Maximum output power

There are no power restrictions on the E5262A and E5263A main-frames. Both mainframes support having both of their modules simultaneously output maximum voltage or current.

Maximum voltage between common and ground

Maximum common to ground voltage must be ± 42 V

Pulse measurement

Pulse width: 500 µsec to 2 s
Pulse period: 5 ms to 5 s
Period ≥ width + 2 ms (when width ≤ 100 ms)
Period ≥ width + 10 ms (when width > 100 ms)
Pulse resolution: 100 µs

Ground unit (GNDU) specification

The GNDU is furnished with the E5262A and E5263A mainframes.

Output voltage: 0 V ± 100 µV
Maximum sink current: 2.2 A
Output terminal/connection: Triaxial connector, Kelvin (remote sensing)

GNDU supplemental information

Load capacitance: 1 µF

Cable resistance:
For IS ≤ 1.6 A: Force line R < 1 Ω
For 1.6 A < IS ≤ 2.0 A: Force line R < 0.7 Ω
For 2.0 A < IS ≤ 2.2 A: Force line R < 0.35 Ω
For all cases: Sense line R ≤ 10 Ω

Where IS 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]

1. ± (% of output/measured value + offset voltage)
2. 200 mA (Vo ≤ 20 V), 50 mA (20 V < Vo ≤ 40 V), Vo is the output voltage in volts.
3. 200 mA (Vo ≤ 20 V), 50 mA (20 V < Vo ≤ 40 V), 20 mA (40 V < Vo ≤ 100 V), Vo 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 (Vo/25))	±(0.1 % + 30 pA + 5 pA x (Vo/25))	100 V
±1 µA	50 pA	50 pA	±(0.12 % + 400 pA + 50 pA x (Vo/25))	±(0.1 % + 200 pA + 50 pA x (Vo/25))	100 V
±10 µA	500 pA	500 pA	±(0.12 % + 5 nA + 500 pA x (Vo/25))	±(0.1 % + 3 nA + 500 pA x (Vo/25))	100 V
±100 µA	5 nA	5 nA	±(0.12 % + 40 nA + 5 nA x (Vo/25))	±(0.1 % + 20 nA + 5 nA x (Vo/25))	100 V
±1 mA	50 nA	50 nA	±(0.12 % + 500 nA + 50 nA x (Vo/25))	±(0.1 % + 300 nA + 50 nA x (Vo/25))	100 V
±10 mA	500 nA	500 nA	±(0.12 % + 4 µA + 500 nA x (Vo/25))	±(0.1 % + 2 µA + 500 nA x (Vo/25))	100 V
±100 mA	5 µA	5 µA	±(0.12 % + 50 µA + 5 µA x (Vo/25))	±(0.1 % + 30 µA + 5 µA x (Vo/25))	[3]
±200 mA	10 µA	10 µA	±(0.12 % + 100 µA + 10 µA x (Vo/50))	±(0.1 % + 60 µA + 10 µA x (Vo/50))	[4]

4. ± (% of output/measured value + offset current A (fixed part determined by the output/measurement range + proportional part that is multiplied by Vo)
5. Round up below decimal point for the value of (Vo/25) and (Vo/50)
6. 100 V (Io ≤ 20 mA), 40 V (20 mA < Io ≤ 50 mA), 20 V (50 mA < Io ≤ 200 mA), Io is the output current in amps.
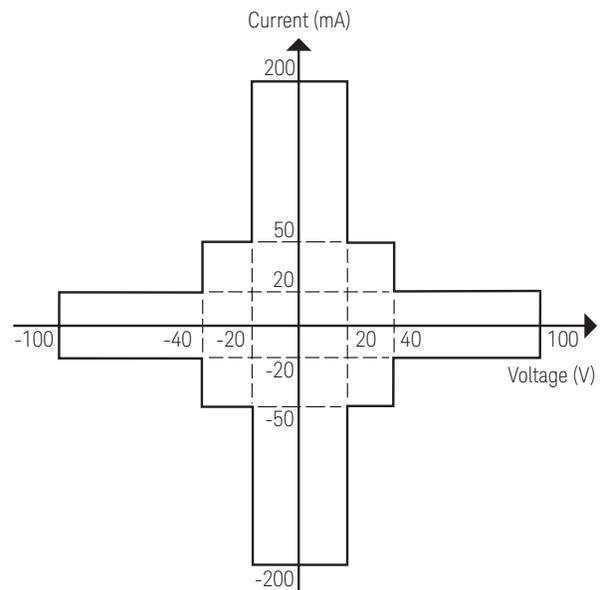
Power consumption (MPSMU)

Voltage source mode:

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

Where Ic is the current compliance setting.

Current source mode:

Voltage compliance	Power
Vc ≤ 20	20 x Io (W)
20 < Vc ≤ 40	40 x Io (W)
40 < Vc ≤ 100	100 x Io (W)

Where Vc is the voltage compliance setting and Io 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 ≤ 100 mA)
Force Line: 1.5 Ω (100 mA < I ≤ 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: ≥ 10^{13} Ω
Current source output resistance: ≥ 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 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)

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 µV	100 µV	±(0.03 % + 900 µV)	±(0.03 % + 700 µV)	1 A
±20 V	1 mV	1 mV	±(0.03 % + 4 mV)	±(0.03 % + 4 mV)	1 A
±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]
±200 V	10 mV	10 mV	±(0.045 % + 30 mV)	±(0.035 % + 40 mV)	[4]

1. ± (% of output/measured value + offset voltage V)
2. 1 A (Vo ≤ 20 V), 500 mA (20 V <Vo ≤ 40 V), Vo is the output voltage in volts.
3. 1 A (Vo ≤ 20 V), 500 mA (20 V <Vo ≤ 40 V), 125 mA (40 V < Vo ≤ 100 V), Vo is the output voltage in volts.
4. 1 A (Vo ≤ 20 V), 500 mA (20 V <Vo ≤ 40 V), 125 mA (40 V < Vo ≤ 100 V), 50 mA (100 V < Vo ≤ 200 V), Vo 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	±(0.12 % + 50 pA + 5 pA x (Vo/25))	±(0.1 % + 30 pA + 5 pA x (Vo/25))	200 V
±1 µA	50 pA	50 pA	±(0.12 % + 400 pA + 50 pA x (Vo/25))	±(0.1 % + 200 pA + 50 pA x (Vo/25))	200 V
±10 µA	500 pA	500 pA	±(0.12 % + 5 nA + 500 pA x (Vo/25))	±(0.1 % + 3 nA + 500 pA x (Vo/25))	200 V
±100 µA	5 nA	5 nA	±(0.12 % + 40 nA + 5 nA x (Vo/25))	±(0.1 % + 20 nA + 5 nA x (Vo/25))	200 V
±1 mA	50 nA	50 nA	±(0.12 % + 500 nA + 50 nA x (Vo/25))	±(0.1 % + 300 nA + 50 nA x (Vo/25))	200 V
±10 mA	500 nA	500 nA	±(0.12 % + 4 µA + 500 nA x (Vo/25))	±(0.1 % + 2 µA + 500 nA x (Vo/25))	200 V
±100 mA	5 µA	5 µA	±(0.12 % + 50 µA + 5 µA x (Vo/25))	±(0.1 % + 30 µA + 5 µA x (Vo/25))	[3]
±1 A	50 µA	50 µA	±(0.5 % + 500 µA + 50 µA x (Vo/25))	±(0.5 % + 300 µA + 50 µA x (Vo/25))	[4]

5. ± (% of output/measured value + offset current A (fixed part determined by the output/measurement range + proportional part that is multiplied by Vo)
6. Round up below decimal point for the value of (Vo/25).
7. 200 V (Io ≤ 50 mA), 100 V (50 mA ≤ Io ≤ 100 mA)
8. 200 V (Io ≤ 50 mA), 100 V (50 mA < Io ≤ 125 mA), 40 V (125 mA < Io ≤ 500 mA), 20 V (500 mA < Io ≤ 1 A), Io is the output current in amps.
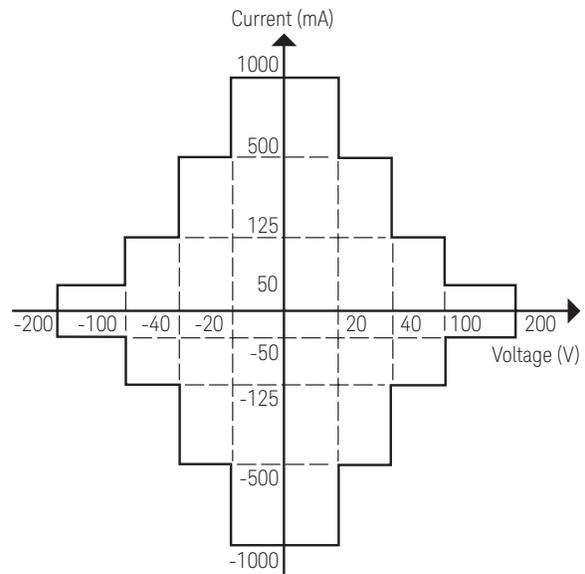
Power consumption (HPSMU)

Voltage source mode:

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

Where Ic is the current compliance setting.

Current source mode:

Voltage compliance	Power
Vc ≤ 20	20 x Io (W)
20 < Vc ≤ 40	40 x Io (W)
40 < Vc ≤ 100	100 x Io (W)
100 < Vc ≤ 200	200 x Io (W)

Where Vc is the voltage compliance setting and Io 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: ≥ 10^{13} Ω
Current source output resistance: ≥ 10^{13} 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

Applies voltage or current, then measures voltage or current. A maximum of two measurement channels can be used.

Staircase sweep measurement mode

Applies staircase sweep voltage or current, and measures voltage or current at each sweep step. A maximum of two measurement channels can be used. An extra sweep source forces the staircase sweep output synchronized to the primary sweep output. 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 µs resolution

Multi-channel sweep measurement mode

Applies staircase sweep voltage or current using multiple sweep sources, and perform staircase sweep measurement. 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 µs resolution

Pulsed spot measurement mode

Applies pulsed voltage or current, and measures voltage or current.
　Pulse width: 500 µs to 2 s, 100 µs resolution
　Pulse period: 5 ms to 5 s 100 µs resolution
　　– Period ≥ width + 2 ms (when width ≤ 100 ms)
　　– Period ≥ width + 10 ms (when width > 100 ms)
　Maximum pulse duty: 50 %

Pulsed sweep measurement mode

Applies pulsed sweep voltage or current, and measures voltage or current at each sweep step. An extra sweep source can be used to force the staircase sweep output synchronized to the pulsed sweep output.

Staircase sweep with pulsed bias measurement mode

Applies pulsed voltage or current, and performs staircase sweep measurement. The staircase sweep output is synchronized to the pulsed bias. A synchronous staircase sweep source is also available.

Quasi-pulsed spot measurement mode

Applies quasi-pulsed voltage or current, and measures voltage or current.

Search measurement mode (liner search and binary search)

Applies voltage or current, and measures voltage or current. Repeats this for various output values until the search stop condition is satisfied. Synchronous output is available.

Time Stamp

The E5262A and E5263A support a time stamp function utilizing an internal quartz clock.
　Resolution: 100 µs

Program Memory

The E5262A and E5263A contain (volatile) memory that can be used to increase test measurement throughput. Program memory allows the storage of program code in the E5262A and E5263A, 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 E5262A and E5263A 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.

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)

E5262A: 400 VA
E5263A: 400 VA

Regulatory compliance

EMC: IEC61326-1/EN61326-1
        AS/NZS CISPR 11
        KC: RRA Notification amending Radio Waves
        Act Article 58-2
Safety: IEC61010-1/EN61010-1
        CAN/CSA-C22.2 No. 61010-1-12, C/US

Certification

CE, CSA, RCM ,KC

Dimensions

E5262A and E5263A: 426 mm W x 150 mm H x 575 mm D

Weight

E5262A: 15 kg
E5263A: 16 kg

Furnished Accessories

– USB-GPIB interface (Keysight 82357B)
– GNDU to Kelvin adaptor (Keysight N1254A-100)
– Triaxial cables for SMU
– Triaxial cable for GNDU
– Interlock cable
– CD-ROMs (EasyEXPERT install media, and VXI *plug&play* driver)

Furnished Software

– EasyEXPERT group+
  See the following section for features and prerequisites.
– VXI *plug&play* driver
  Supported OS: Windows 7 Professional
  (SP1, 32 bit or 64 bit)

Keysight EasyEXPERT group+ Software

Keysight EasyEXPERT group+ GUI based characterization software is available on your PC to accelerate the characterization tasks. It supports efficient and repeatable device characterization in the entire characterization process from measurement setup and execution to analysis and data management either by interactive manual operation or automation across a wafer in conjunction with a semiautomatic wafer prober. EasyEXPERT group+ makes it easy to perform complex device characterization immediately with the ready-to-use measurements (application tests) furnished, and allows you the option of storing test condition and measurement data automatically after each measurement in a unique built-in database (workspace), ensuring that valuable information is not lost and that measurements can be repeated at a later date. Finally, EasyEXPERT has built-in analysis capabilities and a graphical programming environment that facilitate the development of complex testing algorithms.

Key features

– Multiple measurement modes for quick setup and measurement execution (application test, classic test, and quick test)
– Graphical display, automated analysis capabilities and data generation to Excel and image for analysis and reporting
– Built-in database (workspace) records test data automatically and simplifies the data management without numerous data files
– GUI-based control of the Keysight B2200A, B2201A and E5250A switching matrices
– EasyEXPERT remote control function supports the remote measurement execution of application tests that are created on GUI interactively, via the LAN interface
– Data back capability and various data protection feature for shared usage by multiple users
– Characterization environment is available on user's PC as a personal and portable analyzer environment. EasyEXPERT group+ can be installed on any PC as many as needed without additional charge.

Application library

EasyEXPERT group+ comes with the application tests conveniently organized by device type, application, and technology. You can easily edit and customize the furnished application tests to fit your specific needs. Available application tests can be adapted to configured resources.

Measurement modes and functions

Operation Mode

Application test mode
The application test mode provides application oriented point-and-click test setup and execution. An application test can be selected from the library by device type and desired measurement, and then executed after modifying the default input parameters as needed. Available application tests can be adapted to configured resources.

Classic test mode
The classic test mode provides easy access to the instrument setup and measurement execution capabilities.

Tracer test mode
The tracer test mode offers intuitive and interactive sweep control using a rotary knob similar to a curve tracer. Just like an analog curve tracer, you can sweep in only one direction (useful for R&D device analysis) or in both directions (useful in failure analysis applications). Test set ups created in tracer test mode can be seamlessly and instantaneously transferred to classic test mode for further detailed measurement and analysis.

Quick test mode
A GUI-based Quick Test mode enables you to perform test sequencing without programming. You can select, copy, rearrange and cut-and-paste any application tests with a few simple mouse clicks. Once you have selected and arranged your tests, simply click on the measurement button to begin running an automated test sequence.

Other measurement characteristics

Measurement control
Single, repeat, append, and stop

SMU setting capabilities
Limited auto ranging, voltage/current compliance, power compliance, automatic sweep abort functions, self-test, and self-calibration

Standby mode
SMUs in "Standby" remain programmed to their specified output value even as other units are reset for the next measurement.

Bias hold function
This function allows you to keep a source active between measurements. The source module will apply the specified bias between measurements when running classic tests inside an application test, in quick test mode, or during a repeated measurement. The function ceases as soon as these conditions end or when a measurement that does not use this function is started.

Current offset cancel
This function subtracts the offset current from the current measurement raw data, and returns the result as the measurement data. This function is used to compensate the error factor (offset current) caused by the measurement path such as the measurement cables, manipulators, or probe card.

Data display, analysis and arithmetic functions

Data Display

X-Y graph plot
X-axis and up to eight Y-axes, linear and log scale, real time graph plotting.
Scale: Auto scale and zoom
Marker: Marker to min/max, interpolation, direct marker, and marker skip
Cursor: Direct cursor
Line: Two lines, normal mode, grad mode, tangent mode, and regression mode
Overlay graph comparison: Graphical plots can be overlaid.

List display
Measurement data and calculated user function data are listed in conjunction with sweep step number or time domain sampling step number. Up to 20 data sets can be displayed.

Data variable display
Up to 20 user-defined parameters can be displayed on the graphics screen.

Automatic analysis function
On a graphics plot, the markers and lines can be automatically located using the auto analysis setup. Parameters can be automatically determined using automatic analysis, user function, and read out functions.

Analysis functions
Up to 20 user-defined analysis functions can be defined using arithmetic expressions.
Measured data, pre-defined variables, and read out functions can be used in the computation, and the result can be displayed.

Read out functions
The read out functions are built-in functions for reading various values related to the marker, cursor, or line.

Data export
X-Y graph plot can be printed or stored as image data to clipboard or mass storage device. (File type: bmp, gif, png, emf). Graph and list data can be exported to Excel.

Arithmetic functions

User functions
Up to 20 user-defined functions can be defined using arithmetic expressions.
Measured data and pre-defined variables can be used in the computation. The results can be displayed on the LCD.

Arithmetic operators
+, -, *, /, ^, abs (absolute value), at (arc tangent), avg (averaging), cond (conditional evaluation), delta, diff (differential), exp (exponent), integ (integration), lgt (logarithm, base 10), log (logarithm, base e), mavg (moving average), max,min, sqrt, trigonometric function, inverse trigonometric function, and so on.

Physical constants
Keyboard constants are stored in memory as follows:
q: Electron charge, 1.602177E-19 C
k: Boltzman's constant, 1.380658E-23
ε (e): Dielectric constant of vacuum,
8.854188E-12

Engineering units
The following unit symbols are also available on the keyboard:
a (10-18), f (10-15), p (10-12), n (10-9),
u or μ (10-6), m (10-3), k (103), M (106),
G (109), T (1012) , P (1015)

Data management

Workspace (Built-in database)

EasyEXPERT group+ supports the built-in database called "workspace". Workspaces are created on a HDD, and they enable to manage and access all the measurement related data without handling numerous files. Every workspace supports the following features:
  – Access to measurement capabilities and data stored in the workspace.
  – Save/Import/Export measurement settings and data (application library, measurement settings, my favorite setup, and measurement data)
  – Recall the setup for measurement reproduction and data for analysis

Data auto record/auto export

EasyEXPERT group+ has the ability to automatically store the measurement setup and data within a workspace. It can also export measurement data in real time, in a variety of formats such as Excel (xls).

Import/export files

File type:
Keysight EasyEXPERT format, XML-SS format, CSV format

Data Protection

EasyEXPERT group+ has various options to protect important data as follows.
  – Password protection (workspace, test definition and my favorite)
  – User level access control (engineer mode/operator mode)

Workspace back-up and portability

EasyEXPERT group+ has the ability to import/export a workspace for back-up and portability.

EasyEXPERT group+ supported instruments and prerequisites

Supported instruments and features

		Precision Current - Voltage Analyzer Series					Discontinued
		Advanced Device Analyzer		Precision IV Analyzer		Economic IV Analyzer	
		B1500A	B1505A	E5270B	E5262/63A E5260A	B2900A Series SMU	4155B/C 4156B/C
Classic Test	I/V Sweep	Yes	Yes	Yes	Yes	Yes	Yes[1]
	Multi-ch I/V Sweep	Yes	Yes	Yes	Yes	Yes	-
	I/V List Sweep	Yes	Yes	Yes	Yes	Yes	-
	I/V-t Sampling	Yes	Yes	-	-	Yes	Yes
	C-V Sweep	Yes	Yes	-	-	-	-
	SPGU Control	Yes	-	-	-	-	-
	GUI based switching matrix control	Yes[2]	-	Yes[2]	Yes[2]	Yes[2]	Yes[2]
	Direct Control	Yes	Yes	-	-	-	-
Application Test		Yes	Yes	Yes	Yes	Yes	Yes
Tracer Test		Yes (DC/Pulse)	Yes (DC/Pulse)	Yes (DC)	Yes (DC)	Yes (DC/Pulse)	-
Quick Test		Yes	Yes	Yes	Yes	Yes	Yes
Oscilloscope view		Yes[3]	Yes[3]	-	-	-	-
External instrument driver support	LCR meter (4284A/E4980A)	Yes	Yes	Yes	Yes	Yes	Yes
	Pulse Generator (81110A)	Yes	Yes	Yes	Yes	Yes	Yes
	DVM (3458A)	Yes	Yes	Yes	Yes	Yes	Yes
Prober control in Quick Test mode		Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]	Yes[4]
Firmware requirement		A.04.00 or later[5]	A.04.00 or later[5]	B.01.10 or later	B.01.10 or later	1.0 or later	HOSTC: 03.08 or later SMUC: 04.08 or later

1. PGU and VSU/VMU are supported. Differential voltage measurement of VMU is not supported.
2. B2200/01A and E5250A (with E5252A cards) are supported
3. Only available for supported modules.
4. Cascade Microtech Sumit 12000/S300 (Nucleus), Cascade Microtech (Suss MicroTec) PA200/PA300, and Vector Semiconductor VX-2000/VX-3000
5. The latest firmware version is strongly recommended to take full advantage of measurement capabilities.

Prerequisites

Prerequisites to use the EasyEXPERT group+ on an external PC are as follows.

Operating system and service pack	Microsoft Windows Vista Business SP2 or later (32bit)	Microsoft Windows 7 Professional SP1 or later (32bit/64bit)	Microsoft Windows 8.1 Professional or later (32bit/64bit)	Microsoft Windows 10 Pro or later (32bit/64bit)
Processor	Vista certified PC	Windows 7 certified PC	Windows 8.1 certified PC	Windows 10 certified PC
Supported language	English (US)	English (US)	English (US)	English (US)
Memory	2 GB memory	2 GB memory	2 GB memory	2 GB memory
Display	XGA 1024 x 768 (SXGA 1280 x 1024 recommended)	XGA 1024 x 768 (SXGA 1280 x 1024 recommended)	XGA 1024 x 768 (SXGA 1280 x 1024 recommended)	XGA 1024 x 768 (SXGA 1280 x 1024 recommended)
HDD	Installation: 1GB free disk space on the C drive	Installation: 1GB free disk space on the C drive	Installation: 1GB free disk space on the C drive	Installation: 1GB free disk space on the C drive
	Test setup / result data storage: Free disk space more than 30GB is recommended	Test setup / result data storage: Free disk space more than 30GB is recommended	Test setup / result data storage: Free disk space more than 30GB is recommended	Test setup / result data storage: Free disk space more than 30GB is recommended
.NET Framework	Microsoft .NET Framework 3.5 SP1	Microsoft .NET Framework 3.5 SP1	Microsoft .NET Framework 3.5 SP1	Microsoft .NET Framework 3.5 SP1
IO Libraries	Keysight IO Libraries Suite 16.2, 16.3, 17.1 update 1 or later (for the Online execution mode)	Keysight IO Libraries Suite 16.2, 16.3, 17.1 update 1 or later (for the Online execution mode)	Keysight IO Libraries Suite 16.2, 16.3, 17.1 update 1 or later (for the Online execution mode)	Keysight IO Libraries Suite 17.1 update 1 or later (for the Online execution mode)

Recommended GPIB I/F

		Interface	E5270B E5260A E5262/63A
Keysight	82350B/C	PCI	✓
	82351B	PCIe	✓
	82537A/B	USB	✓
National Instruments	GPIB-USB-HS	USB	✓

Measurements Modes

Following table shows the measurement modes supported by the EasyEXPERT group+ and FLEX remote command set.

IV Measurement features	EasyEXPERT group+	Command based programming (FLEX command set)
Spot measurement	Yes	Yes
Pulsed spot measurement	Yes	Yes
Staircase sweep	Yes	Yes
Pulsed sweep	Yes	Yes
Staircase sweep with pulsed bias	Yes	Yes
Multi-channel sweep	Yes	Yes
List Sweep	Yes	–
Quasi-pulsed spot	–	Yes
Linear search	–	Yes
Binary search	–	Yes

Keysight Precision Current-Voltage Analyzer Series and Power Device Analyzer Series
www.keysight.com/find/analyzer

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