Keysight 4082A
Parametric Test System

Data Sheet

KEYSIGHT TECHNOLOGIES

Contents

General Description

The Keysight Technologies, Inc. 4082A parametric test system is designed to perform fast and precise DC measurements, capacitance measurements, and other high frequency applications such as ring oscillator measurement. The system supports up to eight source monitor units (SMUs). Each SMU is self-calibrating, and can be individually configured to force either current or voltage, as well as simultaneously measure either current or voltage. The system also supports a fully guarded switching matrix customizable from 12 to 48 pins. One special additional pin is dedicated as a chuck connection.

The Keysight 4082A can be constructed in either a low-current or an ultra-low current configuration, depending upon the type of matrix card specified. Only 4082A models containing the ultra-low current matrix cards can use the high-resolution SMU (HRSMU).

An optional high-speed capacitance measurement unit (HSCMU) is available for the 4082A, which enables the measurement of capacitance and impedance with unprecedented speed. External instruments can be integrated into the system via six auxiliary input ports or forty eight extended path inputs. The extended path inputs allow the user to connect external signals directly to the DUT pins.

Another option offered for the 4082A is a high-frequency switching matrix. The high-frequency matrix is organized as two 3 x 24 matrices (six inputs in total), and 1 TO 2 furnished cables may be used on each matrix pair to create one 3 x 48 matrix (three inputs in total). The system also has one 1.6 A ground unit.

Measurement functions

DC current, DC voltage, capacitance and conductance, impedance and differential voltage.

Key measurement features

DC measurements		
Measurement unit		HRSMU (High resolution SMU)[1]
		MPSMU (Medium power SMU)
		HPSMU (High power SMU)
Measurement functions		Spot, sweep, pulse bias, and pulse sweep
Measurement range	Using two low current SMU ports	1 fA[2] to 100 mA, 2 µV to 100 V
	Using six standard SMU ports	10 fA to 1 A[3], 2 µV to 200 V[3]
Capacitance, conductance and impedance measurement		
Measurement unit		High speed capacitance measurement unit (HS-CMU)
		Keysight E4980A LCR meter
HS-CMU	Measurement functions	C/G, C/G-V, C/G-V/f, Z/θ and Z/θ-f
	Measurement frequencies	1 kHz to 2 MHz, 34 points
	Measurement ranges	1 fF to 100 nF, 0.1 nS to 7.5 mS
	DC bias voltage	±10 V
Keysight E4980A	Measurement functions	C/G and C/G-V
	Measurement frequencies	1 kHz, 10 kHz, 100 kHz and 1 MHz
	Measurement ranges	1 fF to 100 nF, 0.1 nS to 7.5 mS
	DC bias voltage	±40 V
Two terminal differential voltage measurements		
Measurement unit		Keysight 3458A
Measurement range		0.1 µV to 100 V (only when using ultra-low current matrix cards), or 1 µV to 100 V
Switching matrix		
Number of measurement pins		Between 12 and 48 pins Note: One additional pin is dedicated for the prober chuck connection.
Instrument ports		Up to eight SMUs
		One ground unit (GNDU)
		Eight auxiliary (AUX) ports (two ports are used for HS-CMU)
		48 extended paths
		Six optional high-frequency (HF) ports and pulse switch input/output ports

1. Can be used only with ultra-low current matrix cards
2. Using HRSMU. Using MPSMU, 10 fA to 100 mA, 2 µV to 100 V
3. Using optional HPSMU. Using MPSMU, 10 fA to 100 mA, 2 µV to 100 V

Specification

Specification conditions

Accuracy is specified under the conditions below.

Specification conditions	
Temperature	23°C ± 5°C
Humidity	15% to 70% RH[1]
Warm up time	At least 60 min.
Self-calibration	Within one hour after calibration
Integration time	Medium or long[2]

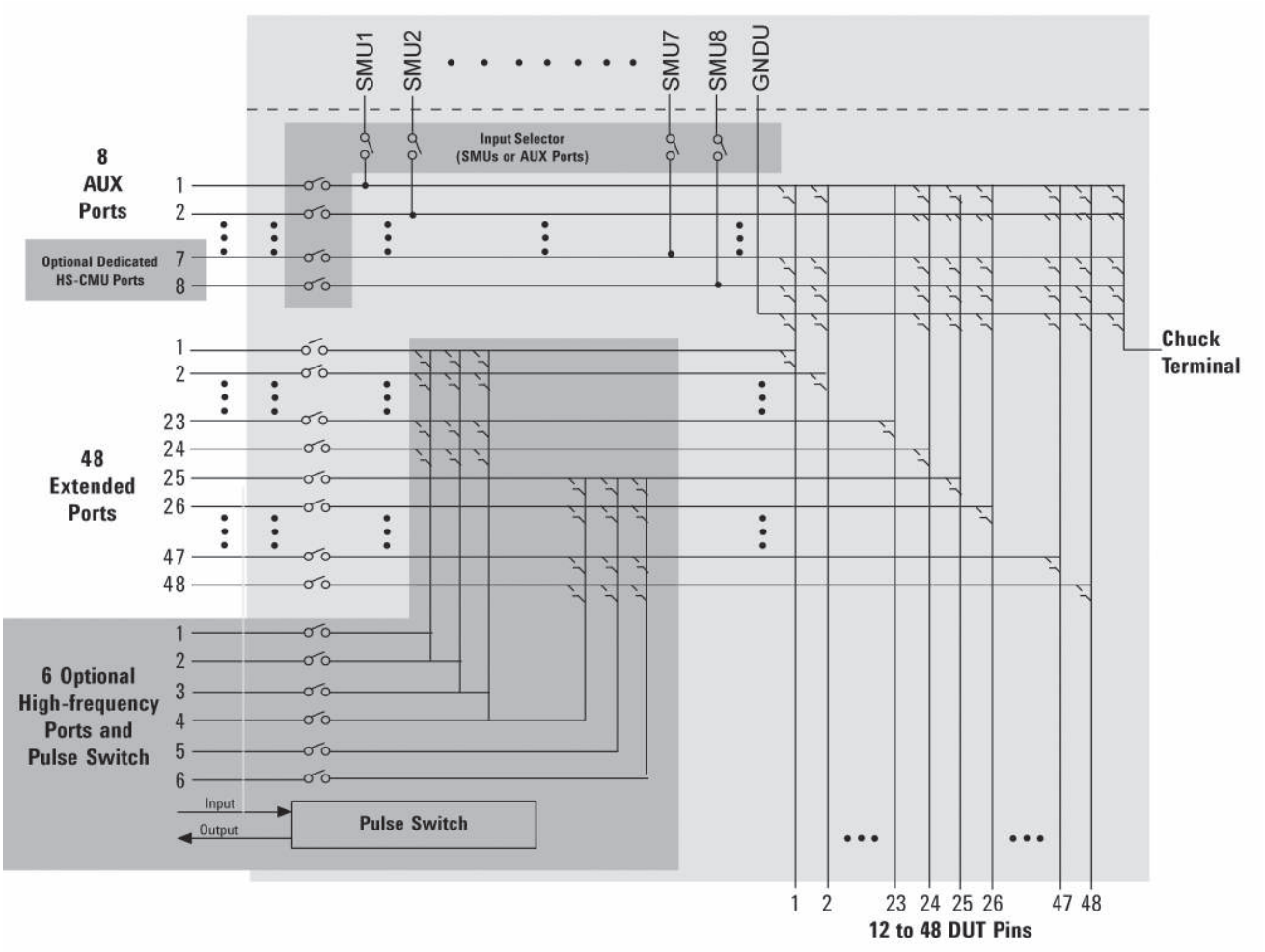
1. 5% to 60% RH (no condensation) for current measurement accuracy of the HRSMU in 10 pA to 100 nA range and isolation resistance of the low-current port
2. For SMU current ranges that are less than or equal to 1 nA, the integration time must be Long (16 PLC or longer). Note: The temperature changes after calibration must be less than 3° C.

Switching matrix subsystem

Switching matrix subsystem		
Maximum DUT pins		48 output pins plus one pin for the prober chuck connection (triaxial connector). Two types of DC switching matrix cards are available: standard low-current and ultra-low current.
Maximum number of instrument ports	SMU port in test head	Eight SMUs + one GNDU - Two ports for low-current measurement (Non-Kelvin) - Four ports (Kelvin) - Two ports (Non-Kelvin) - One port for GNDU (Kelvin)
	Auxiliary ports	Six for external instruments (Digital voltmeter, etc.) and two for HS-CMU or E4980A - Two triaxial input ports (Force/guard/common, AUX ports 1 and 2) - Four BNC two-pair input ports (Force/common and sense/common, AUX ports 3 to 6) - Two BNC input ports (Force/common, AUX ports 7 and 8, connected to HSCMU in default)
	Extended path:	48 extended paths The system provides one on/off relay for each path.
Maximum voltage at each port	SMU port in test head	±200 V
	AUX port	±200 V (AUX ports 1 and 2) ±100 V (AUX ports 3 to 8)
	Optional HF ports	±100 V (between force and common of each HF port) ±100 V (between two of forces of all HF ports) ±100 V (between any force of HF ports and any force of extended paths)
	Extended path	±100 V (between force and common of each extended path) ±100 V (between any force of the optional HF ports and any force of extended paths)
	Zero reference	±200 mV
Maximum current, port to DUT pin	SMU port in test head	±1.0 A
	GNDU	±1.6 A
	AUX port	±1.0 A
	Optional HF ports	±0.5 A
	Extended path	±0.5 A
Maximum residual resistance	Through AUX port	Low current port: Force 1.0 Ω Kelvin port: Force 1.0 Ω, Sense 2.5 Ω Non-Kelvin port: Force 1.0 Ω
Maximum stray capacitance between DUT pins		3 pF (supplemental characteristics)
Isolation resistance		Low current (with guard): 1×10^{15} Ω (supplemental characteristics)

Optional high frequency (HF) ports	
Maximum number of instrument ports	Six ports for external instruments. HF ports 1 through 3 can access measurement pins 1 through 24, and HF ports 4 through 6 can access measurement pins 25 through 48. The user has the option of connecting any of the following HF port pairs together via a 1 TO 2 cable in order to access all (1 through 48) measurement pins: HF ports 1 and 4, HF ports 2 and 5, and HF ports 3 and 6.
Maximum residual resistance	2.0 Ω (supplemental characteristics)
Optional HF port bandwidth (@ –3 dB)	60 MHz (50 Ω load impedance: from port to DUT pin, 3 × 24 configuration, supplemental characteristics)
Optional HF port cross talk between pins	±2% (5 kΩ load impedance: from port to DUT pin, 20 ns pulse transition time, supplemental characteristics)

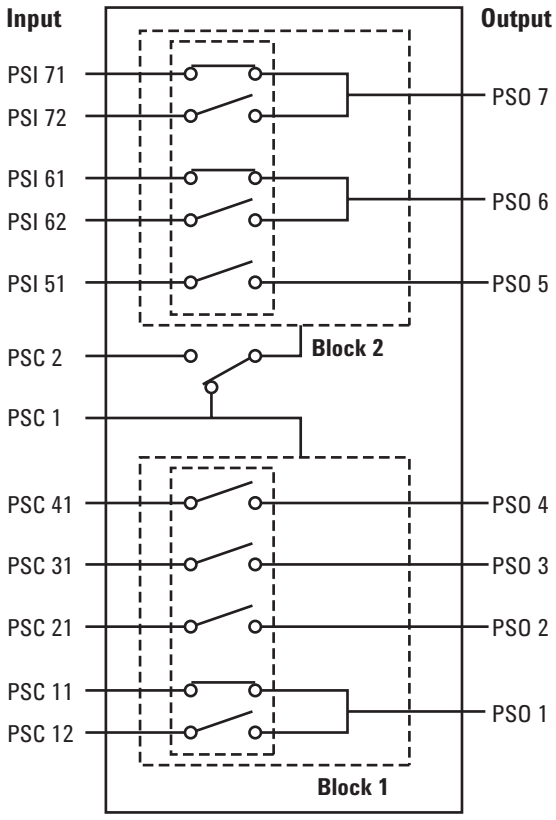
Testhead Circuit Diagram



Optional pulse switch

The optional pulse switch includes seven semiconductor switching relays, for reliable and direct control of pulse shaping by the pulse generator or CPU. The pulse switch is integrated into the 4082A test head.

Maximum number of instrument ports	Please refer to page 8.
Number of blocks	2
Number of switches of each block	Block 1: Three relays (make or break, selectable type) and 1 relay (transfer type to create multilevel pulse) Block 2: One relay (make or break, selectable type) and two relays (transfer type to create multilevel pulse)
Control input port	One input per each block (PSC1 and PSC2)
Control method	Both the PG and CPU can control all switches. PG or CPU control is independent for every block. In the case of PG control, block 1 can be controlled by the PSC1 input, and block 2 can be controlled by either PSC1 or PSC2 (selectable).
Mode of relay control	Make or break, selectable type relay: Normally open or normally closed modes are selectable. Transfer type relay: Normally open and normally closed modes are not selectable.
Maximum voltage	±40 V between force and common of each switch between PSI 21 and PSO 2 between PSI 31 and PSO 3 between PSI 41 and PSO 4 between PSI 51 and PSO 5 between PSI 11 (or PSI 12) and PSO 1 between PSI 11 and PSI 12 between PSI 61 (or PSI 62) and PSO 6 between PSI 61 and PSI 62 between PSI 71 (or PSI 72) and PSO 7 between PSI 71 and PSI 72)
Maximum current	±0.4 A (from input to output)
Maximum residual resistance	Nominal 1.5 Ω (from IN to OUT, supplemental characteristics)
OFF capacitance	50 pF (between IN and OUT: Vin–Vout = 0 V) 100 pF (between force and common @output of make or break, selectable type relay: Vin–Vout = 0 V) (supplemental characteristics)
Operating time of switching	Max. 500 µs (supplemental characteristics)



Pulse switch

DC Measurement Subsystem

SMU (Source and monitor unit)

Voltage source/monitor range, resolution, and accuracy using HRSMU

Full scale voltage range	Force resolution	Measure resolution: high speed	Measure resolution precision	Measure accuracy	Force accuracy
				a: 0.02%	a: 0.03%
±2 V	100 µV	100 µV	2 µV	b: 0.025%	b: 0.035%
				c: Rmat × Io	c: Rmat × Io
±20 V	1 mV	1 mV	20 µV	a: 0.02%	a: 0.03%
±40 V	2 mV	2 mV	40 µV	b: 0.015%	b: 0.02%
±100 V	5 mV	5 mV	100 µV	c: Rmat × Io	c: Rmat × Io

Voltage source/monitor range, resolution, and accuracy using MPSMU and HPSMU

Full scale voltage range	Force resolution	Measure resolution: high speed	Measure resolution precision	Measure accuracy	Force accuracy
±2 V	100 µV	100 µV	2 µV	a: 0.05%	a: 0.04%
±20 V	1 mV	1 mV	20 µV	b: 0.05%	b: 0.04%
±40 V	2 mV	2 mV	40 µV	c: Rmat × Io	c: Rmat × Io
±100 V	5 mV	5 mV	100 µV		
±200 V[1]	10 mV	10 mV	200 µV		a: 0.045%
					b: 0.04%
					c: Rmat × Io

1. Using HPSMU

Note: Force accuracy is calculated as follows: ±(a% of output setting value + b% of output voltage range + c) (V)
Measure accuracy is calculated as follows: ±(a% of measure value + b% of measurement voltage range + c) (V)
Io = Output current, Rmat = Residual resistance of switching matrix force port
Note: Rmat is different at each port. When using prober chuck connection pin, add 0.1 Ω to Rmat.
Low current port (SMU1 and SMU2): 1.0 Ω
Kelvin port: (SMU3 to SMU6); 3 mΩ
Non-Kelvin port (SMU7 and SMU8): 1.0 Ω

Current source/monitor range, resolution, and accuracy using an MPSMU connected to ports SMU1 and SMU2

Full scale current range	Force resolution	Measure resolution: high speed	Measure resolution: precision	Force accuracy	Measure accuracy
±100 mA	5 µA	5 µA	100 nA	a: 0.12% b: 0.1 + 0.0005 × Vo % c: 0	a: 0.1% b: 0.05 + 0.0005 × Vo % c: 0
±10 mA	500 nA	500 nA	10 nA		
±1 mA	50 nA	50 nA	1 nA		
±100 µA	5 nA	5 nA	100 pA		
±10 µA	500 pA	500 pA	10 pA		
±1 µA	50 pA	50 pA	1 pA	a: 0.2% b: 0.1 + 0.0005 ×Vo % c: 0.02 pA/V × Vo	a: 0.2% b: 0.05 + 0.0005 × Vo % c: 0.02 pA/V × Vo
±100 nA	5 pA	5 pA	100 fA		
±10 nA	500 fA	500 fA	10 fA	a: 1% b: 0.1 + 0.0005 × Vo % c: 3 pA + 0.02 pA/V × Vo	a: 1% b: 0.1 + 0.0005 × Vo % c: 3 pA + 0.02 pA/V × Vo
±1 nA	50 fA	50 fA	10 fA		

Note: The HPSMU cannot be connected to SMU1 and SMU2 ports.
Current measurement accuracy of the SMU may be affected by elecromagnetic field strength over 3 V/m at a frequency of 80 MHz to 1 GHz.

Current source/monitor range, resolution, and accuracy using HRSMU connected to ports SMU1 and SMU2

Full scale current range	Force resolution	Measure resolution: high speed	Measure resolution: precision	Force accuracy	Measure accuracy
±100 mA	5 µA	5 µA	100 nA	a:0.12% b: 0.05 + 0.0001 × Vo % c: 0	a: 0.1% b: 0.04 + 0.0001 × Vo % c: 0
±10 mA	500 nA	500 nA	10 nA	a: 0.06% b: 0.04 + 0.0001 × Vo % c: 0	a: 0.06% b: 0.03 + 0.0001 × Vo % c: 0
±1 mA	50 nA	50 nA	1 nA	a: 0.06% b: 0.05 + 0.0001 × Vo % c: 0	a: 0.06% b: 0.04 + 0.0001 × Vo % c: 0
±100 µA	5 nA	5 nA	100 pA	a: 0.07% b: 0.04 + 0.0001 × Vo % c: 0	a: 0.06% b: 0.035 + 0.0001 × Vo % c: 0
±10 µA	500 pA	500 pA	10 pA	a: 0.07% b: 0.05 + 0.0001 × Vo % c: 0	a: 0.06% b: 0.04 + 0.0001 × Vo % c: 0
±1 µA	50 pA	50 pA	1 pA	a: 0.12% b: 0.04 + 0.0001 × Vo % c: 0	a: 0.12% b: 0.035 + 0.0001 × Vo % c: 0
±100 nA	5 pA	5 pA	100 fA	a: 0.12% b: 0.05 + 0.0001 × Vo % c: 1 fA/V × Vo	a: 0.12% b: 0.04 + 0.0001 × Vo % c: 1 fA/V × Vo
±10 nA	500 fA	500 fA	10 fA	a: 1% b: 0.05 + 0.0001 × Vo % c: 3 pA + 1 fA/V × Vo	a: 1% b: 0.04 + 0.0001 × Vo % c: 3 pA + 1 fA/V × Vo
±1 nA	50 fA	50 fA	10 fA	a: 1% b: 0.07 + 0.0001 × Vo % c: 3 pA + 1 fA/V × Vo	a: 1% b: 0.04 + 0.0001 × Vo % c: 3 pA + 1 fA/V × Vo
±100 pA	5 fA	5 fA	2 fA	a: 4% b: 0.04 + 0.0001 × Vo % c: 500 fA + 1 fA/V × Vo	a: 4% b: 0.12 + 0.0001 × Vo % c: 500 fA + 1 fA/V × Vo
±10 pA	1 fA	2 fA	1 fA	a: 4% b: 0.04 + 0.0001 × Vo % c: 500 fA + 1 fA/V × Vo	a: 4% b: 1.0 + 0.0001 × Vo % c: 500 fA + 1 fA/V × Vo

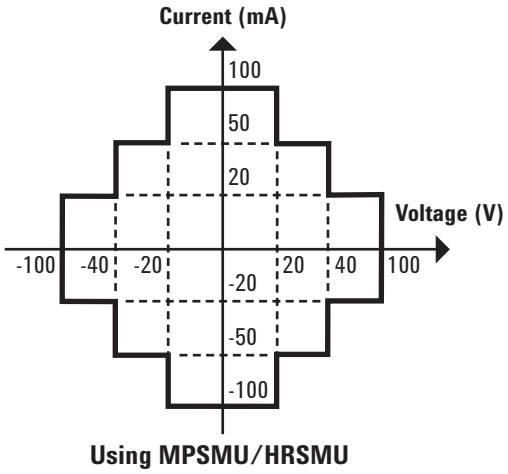
Current source/monitor range, resolution, and accuracy using an MPSMU or HPSMU connected to ports SMU3 to SMU8

Full scale current range	Force resolution	Measure resolution: high speed	Measure resolution: precision	Force accuracy	Measure accuracy
±1 A[1]	50 µA	50 µA	1 µA	a: 0.5% b: 0.1 + 0.0005 × Vo% c: 0	a: 0.5% b: 0.05 + 0.0005 × Vo % c: 0
±100 mA	5 µA	5 µA	100 nA	a: 0.12% b: 0.1 + 0.0005 × Vo% c: 0	a: 0.1% b: 0.05 + 0.0005 × Vo % c: 0
±10 mA	500 nA	500 nA	10 nA		
±1 mA	50 nA	50 nA	1 nA		
±100 µA	5 nA	5 nA	100 pA		
±10 µA	500 pA	500 pA	10 pA		
±1 µA	50 pA	50 pA	1 pA	a: 0.2% b: 0.1 + 0.0005 × Vo% c: 300 pA + 10 pA/V × Vo	a: 0.2% b: 0.05 + 0.0005 × Vo % c: 300 pA + 10 pA/V × Vo
±100 nA	5 pA	5 pA	100 fA		
±10 nA[2]	500 fA	500 fA	10 fA	a: 1% b: 0.1 + 0.0005 × Vo% c: 303 pA + 10 pA/V × Vo	a: 1% b: 0.1 + 0.0005 × Vo % c: 303 pA + 10 pA/V × Vo
±1 nA2	50 fA	50 fA	10 fA		

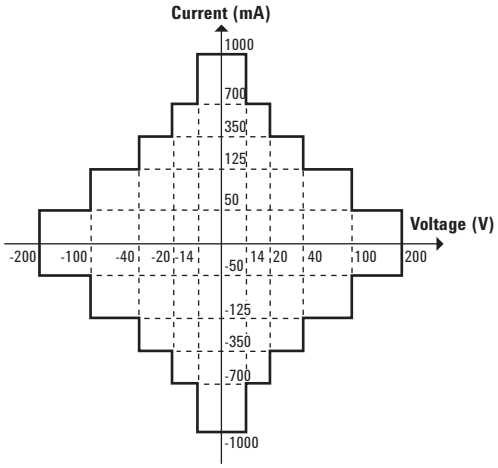
1. Using HPSMU
2. Supplemental characteristics when using the SMU3 to SMU8 ports

Note: Force accuracy is calculated as follows: ±(a% of output setting value + b% of output current range + c) (A)
Measure accuracy is calculated as follows: ±(a% of measured value + b% of current measurement range + c) (A)
Note: The HPSMU can only be connected to the SMU3 and SMU4 ports.
Note: Current measurement accuracy of the SMU may be affected by elecromagnetic field strength over 3 V/m at a frequency of 80 MHz to 1 GHz.
Vo = Output voltage

SMU other specifications	
Over current range	15% of range (0% for 100 mA range of MPSMU/HRSMU, 0% for 1 A range of HPSMU, 5% for 10 pA/100 pA range of HRSMU)
Over voltage range	V force: % of range V measure: 10% of range (0% for 100 V range of MPSMU, 0% for 200 V range of HPSMU)
Current compliance setting range	1 pA to maximum current
Accuracy of converse polar current limit:[3]	±2% of range (100 nA to 1 A ranges) ±10% of range (10 pA to 10 nA ranges)
Maximum capacitive load	≤ 1000 pF
Maximum allowable guard capacitance	250 pF (between signal line and guard line outside of matrix)
Maximum slew rate	0.2 V/µs



Using MPSMU/HRSMU



Using HPSMU

GNDU

This unit is used for ground when making measurements.

Specifications	
Output voltage	0 V
Maximum current	±1.6 A
Offset voltage	±200 µV
Maximum capacitance load	1 µF (supplemental characteristics)

Digital volt meter (Keysight 3458A)

Voltage measurement range, resolution, and accuracy (at number of power line cycles ≥ 1)

Specifications		
Full-scale voltage range	**Resolution**	**Accuracy (% of reading + volt)**
0.1 V	0.1 µV	0.01% + 100 µV
1 V	1 µV	0.01% + 100 µV
10 V	10 µV	0.01% + 200 µV
100 V	100 µV	0.02% + 1 mV

SMU configuration

The default SMU configuration depends upon the matrix card that is chosen (standard low current or ultra-low current). Please refer to the tables below, which show the SMU installation configuration associated with different combinations of SMU resource options.

SMU installation when using ultra-low current matrix cards

No HPSMU			One HPSMU			Two HPSMUs		
Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order
1	MPSMU	2	1	MPSMU	1	1	MPSMU	Fixed
2	MPSMU	Fixed	2	MPSMU	Fixed	2	MPSMU	Fixed
3	MPSMU	Fixed	3	**HPSMU**	**Fixed**	3	**HPSMU**	**Fixed**
4	MPSMU	Fixed	4	MPSMU	Fixed	4	**HPSMU**	**Fixed**
5	MPSMU	1	5	MPSMU	Fixed	5	MPSMU	Fixed
6	MPSMU	3	6	MPSMU	2	6	MPSMU	1
7	MPSMU	4	7	MPSMU	3	7	MPSMU	2
8	MPSMU	5	8	MPSMU	4	8	MPSMU	3

SMU installation when using ultra-low current matrix cards

One HRSMU, no HPSMUs			One HRSMU, one HPSMU			One HRSMU, two HPSMUs		
Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order
1	MPSMU	2	1	MPSMU	1	1	MPSMU	Fixed
2	**HRSMU**	**Fixed**	2	**HRSMU**	**Fixed**	2	**HRSMU**	**Fixed**
3	MPSMU	Fixed	3	**HPSMU**	**Fixed**	3	**HPSMU**	**Fixed**
4	MPSMU	Fixed	4	MPSMU	Fixed	4	**HPSMU**	**Fixed**
5	MPSMU	1	5	MPSMU	Fixed	5	MPSMU	Fixed
6	MPSMU	3	6	MPSMU	2	6	MPSMU	1
7	MPSMU	4	7	MPSMU	3	7	MPSMU	2
8	MPSMU	5	8	MPSMU	4	8	MPSMU	3
Two HRSMUs, no HPSMUs			**Two HRSMUs, one HPSMU**			**Two HRSMUs, two HPSMUs**		
Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order	Port number	Installed SMU	Installation order
1	**HRSMU**	**Fixed**	1	**HRSMU**	**Fixed**	1	**HRSMU**	**Fixed**
2	**HRSMU**	**Fixed**	2	**HRSMU**	**Fixed**	2	**HRSMU**	**Fixed**
3	MPSMU	Fixed	3	**HPSMU**	**Fixed**	3	**HPSMU**	**Fixed**
4	MPSMU	Fixed	4	MPSMU	Fixed	4	**HPSMU**	**Fixed**
5	MPSMU	1	5	MPSMU	Fixed	5	MPSMU	Fixed
6	MPSMU	2	6	MPSMU	1	6	MPSMU	Fixed
7	MPSMU	3	7	MPSMU	2	7	MPSMU	1
8	MPSMU	4	8	MPSMU	3	8	MPSMU	2

Note: Installation order indicates the order in which additional MPSMUs must be installed.

Capacitance Measurement Subsystem

High-speed CMU (Capacitance measurement unit)

Measurement accuracy is specified between any two measurement pins except the chuck connection pin.

Specifications				
Measurement range			1 fF to 1.2 nF and 10 nS to 7.5 mS (1 MHz) 1 fF to 10 nF and 1 nS to 6.3 mS (100 kHz) 1 fF to 100 nF and 0.1 nS to 6.3 mS (10 kHz) 10 fF to 100 nF and 0.1 nS to 63 mS (1 kHz)	
Measurement frequency			Setting range 1 kHz to 2 MHz (34 points)	
Test signal level			Setting range 10 mV, 30 mV, 50 mV, and 100 mV	
DC bias		Full-scale voltage range	±10 V (Setting resolution: 1 mV)	
		Force accuracy	±(0.1% of setting + 10 mV)	
C/G measurement range, resolution, and accuracy				
Frequency	**C range**	**C accuracy ±(% of reading + % of range)**	**G range**	**G accuracy ±(% of reading + % of range)**
2 MHz*	7 pF	3.2% + [6.3 + (2.3 × Gm/88 µS)]%	88 µS	3.2% + [6.5 + (2.5 × Cm/7 pF)]%
	70 pF	2.8% + [2.3 + (1.9 × Gm/880 µS)]%	880 µS	2.8% + [2.4 + (2.1 × Cm/70 pF)]%
1 MHz	10 pF*	0.8% + [1.1 + (0.6 × Gm/63 µS)]%	63 µS*	0.8% + [1.1 + (0.6 × Cm/10 pF)]%
	100 pF	0.7% + [0.4 + (0.5 × Gm/630 µS)]%	630 µS	0.7% + [0.4 + (0.5 × Cm/100 pF)]%
	1 nF	1.5% + [0.3 + (2.1 × Gm/6.3 mS)]%	6.3 mS	1.5% + [0.3 + (2.2 × Cm/1 nF)]%
100 kHz	10 pF*	0.4% + [1.1 + (0.3 × Gm/6.3 µS)]%	6.3 µS*	0.4% + [1.1 + (0.4 × Cm/10 pF)]%
	100 pF	0.2% + [0.4 + (0.2 × Gm/63 µS)]%	63 µS	0.2% + [0.4 + (0.2 × Cm/100 pF)]%
	1 nF	0.2% + [0.3 + (0.4 × Gm/630 µS)]%	630 µS	0.2% + [0.3 + (0.4 × Cm/1 nF)]%
	10 nF	0.5% + [0.3 + (1.0 × Gm/6.3 mS)]%	6.3 mS	0.5% + [0.3 + (1.0 × Cm/10 nF)]%
10 kHz	100 pF	0.3% + [0.2 + (0.3 × Gm/6.3 µS)]%	6.3 µS	0.3% + [0.2 + (0.3 × Cm/100 pF)]%
	1 nF	0.2% + [0.2 + (0.2 × Gm/63 µS)]%	63 µS	0.2% + [0.2 + (0.2 × Cm/1 nF)]%
	10 nF	0.2% + [0.2 + (0.2 × Gm/630 µS)]%	630 µS	0.2% + [0.2 + (0.2 × Cm/10 nF)]%
	100 nF	0.3% + [0.2 + (1.0 × Gm/6.3 mS)]%	6.3 mS	0.7% + [0.2 + (0.7 × Cm/100 nF)]%
1 kHz	100 pF*	0.3% + [0.4 +(0.3 × Gm/0.63 µS)]%	0.63 µS*	0.3% + [0.4 + (0.3 × Cm/100 pF)]%
	1 nF	0.3% + [0.1 + (0.3 × Gm/6.3 µS)]%	6.3 µS	0.3% + [0.1 + (0.3 × Cm/1 nF)]%
	10 nF	0.3% + [0.1 + (0.3 × Gm/63 µS)]%	63 µS	0.3% + [0.1 + (0.3 × Cm/10 nF)]%
	100 nF	0.3% + [0.1 + (0.3 × Gm/630 µS)]%	630 µS	0.3% + [0.1 + (0.3 × Cm/100 nF)]%

* Supplemental characteristics
Gm: Measured conductance
Cm: Measured capacitance
Conductance and capacitance measurements are specified under the following conditions:

- Measurement frequency: 1 kHz, 10 kHz, 100 kHz, or 1 MHz
- Integration time: MEDIUM or LONG
- Test signal level: 30 mVrms
- Stray capacitance: Must be under 5 pF between force and guard
- Calibration and offset cancel: Specifications are valid for the data after calibration data measurement and offset cancel.
- Capacitance measurement accuracy of HSCMU may be affected by conducted RF field strength over 3 Vrms at frequency range of 1 MHz to 20 MHz.

Z/θ neasurement accuracy (Supplemental characteristics)			
Frequency	**C range**	**C accuracy ±(% of reading + % of range)**	**θ accuracy**
1 MHz	10 kΩ	0.8% + 1.8%	±0.26 rad
	1 kΩ	0.7% + 0.6%	±0.02 rad
	100 Ω	1.5% + 0.5%	±0.02 rad
100 kHz	100 kΩ	0.4% + 1.8%	±0.03 rad
	10 kΩ	0.2% + 0.6%	±0.01 rad
	1 kΩ	0.2% + 0.5%	±0.01 rad
	100 Ω	0.5% + 0.5%	±0.01 rad
10 kHz	100 kΩ	0.3% + 0.3%	±0.01 rad
	10 kΩ	0.2% + 0.3%	±0.01 rad
	1 kΩ	0.2% + 0.3%	±0.01 rad
	100 kΩ	0.3% + 0.3%	±0.01 rad
1 kHz	100 kΩ	0.3% + 0.2%	±0.01 rad
	10 kΩ	0.3% + 0.2%	±0.01 rad
	1 kΩ	0.3% + 0.2%	±0.01 rad

Keysight E4980A LCR meter

Measurement accuracy is specified between any two measurement pins except the chuck connection pin and after calibration data measurement and offset cancel.

Specifications		
Measurement range		1 fF to 1.2 nF and 10 nS to 7.5 mS (1 MHz) 1 fF to 10 nF and 1 nS to 6.3 mS (100 KHz) 1 fF to 100 nF and 0.1 nS to 6.3 mS (10 KHz) 10 fF to 100 nF and 0.1 nS to 0.63 mS (1 KHz)
Measurement frequency		1 KHz, 10 KHz, 100 KHz, and 1 MHz
Test signal level		30 mV (rms)
DC bias	Full-scale voltage range	±40 V
	Force accuracy	±(0.1% of setting + 10 mV)
	Bias current isolation function	OFF

Note: Above specifications are valid after calibration data measurement and offset cancel.

Keysight E4980A LCR meter

Measurement accuracy is specified between any two measurement pins except the chuck connection pin and after calibration data measurement and offset cancel.

C/G measurement range, resolution, and accuracy

Frequency	C range	C accuracy % of reading + % of range	G range	G accuracy % of reading + % of range
1 MHz	10 pF[1]	0.8% + [1.0 + (0.6 × Gm^2 /63 µS)]%	63 µS[1]	0.8% + [1.0 + (0.6 × Cm^3/10 pF)]%
	100 pF	0.8% + [0.3 + (0.6 × Gm/630 µS)]%	630 µS	0.8% + [0.3 + (0.6 × Cm/100 pF)]%
	1 nF	1.5% + [0.2 + (1.7 × Gm/6.3 mS)]%	6.3 mS	1.3% + [0.2 + (2.2 × Cm/1 nF)]%
100 kHz	10 pF[1]	0.4% + [1.0 + (0.3 × Gm/6.3 µS)]%	6.3 µS[1]	0.4% + [1.0 + (0.4 × Cm/10 pF)]%
	100 pF	0.3% + [0.3 + (0.3 ´ Gm/63 µS)]%	63 µS	0.3% + [0.3 + (0.3 × Cm/100 pF)]%
	1 nF	0.3% + [0.2 + (0.4 × Gm/630 µS)]%	630 µS	0.3% + [0.2 + (0.4 × Cm/1 nF)]%
	10 nF	0.5% + [0.2 + 1.0 × (Gm/6.3 mS)]%	6.3 mS	0.7% + [0.2 + (0.8 × Cm/10 nF)]%
10 kHz	100 pF	0.3% + [0.2 + (0.3 × Gm/6.3 µS)]%	6.3 µS	0.3% + [0.2 + (0.3 × Cm/100 pF)]%
	1 nF	0.3% + [0.1 + (0.3 × Gm/63 µS)]%	63 µS	0.3% + [0.1 + (0.3 × Cm/1 nF)]%
	10 nF	0.3% + [0.1 + (0.3 × Gm/630 µS)]%	630 µS	0.3% + [0.1 + (0.3 × Cm/10 nF)]%
	100 nF	0.3% + [0.1 + (1.0 × Gm/6.3 mS)]%	6.3 mS	0.7% + [0.1 + (0.7 × Cm/100 nF)]%
1 kHz	100 pF[1]	0.4% + [0.5 +(0.4 × Gm/0.63 µS)]%	0.63 µS[1]	0.4% + [0.5 + (0.4 × Cm/100 pF)]%
	1 nF	0.3% + [0.1 + (0.3 × Gm/6.3 µS)]%	6.3 µS	0.3% + [0.1 + (0.3 × Cm/1 nF)]%
	10 nF	0.3% + [0.1 + (0.3 × Gm/63 µS)]%	63 µS	0.3% + [0.1 + (0.3 × Cm/10 nF)]%
	100 nF	0.3% + [0.1 + (0.3 × Gm/630 µS)]%	630 µS	0.3% + [0.1 + (0.3 × Cm/100 nF)]%

1. Supplemental characteristics
2. Gm = Measured conductance
3. Cm = Measured capacitance

Note: Accuracy is specified between any DUT pins. Stray capacitance between force and guard must be under 5 pF.
Frequency accuracy: ±0.1%; Test signal level: 30 mV_{rms} ± 5 mV_{rms}
When measurement speed is set to SHORT, add 0.25% to the % of reading and 0.1% to the % of range.
When open/short calibrations at the DUT pins are carried out, accuracy is the same as in the above table. (Note that the length of cable from the output pins must be less than 1 meter, and capacitance to guard must be under 100 pF.

Software

System software

- Standard 4080 software provides the following capabilities.
- System management
- Control of subsystems (TIS library)
- Parameter measurement utility (PARA library)
- Off-line debugging
- Interactive debugging panel (IDP: Includes test algorithm code generating function)
- Automatic diagnostics

Keysight SPECS (Semiconductor process evaluation core software)

Keysight SPECS is a test shell environment for the 4080 Series. Users have full access to the Linux environment from within the test shell. The 4080 series requires SPECS version D.03.10 or later.

Test development	User interaction occurs via a graphical interface with spreadsheet-like operation. Test plans require simple specifications: wafer, die, test, and probe.
Customization	Keysight supplies basic development,engineering, and operator test shell frameworks, which users can tailor or modify to create entirely new frameworks.
Analysis & output	All data is output into a flat ASCII file which users can manipulate to allow for input into database software. In addition, the data management structure supports x-y graphs, histograms, and wafer maps.

Keysight SPECS-FA

SPECS-FA, the factory automation version of Keysight's SPECS test shell, runs on all models of the 4080 Series tester family. SPECS-FA fully supports SEMI automation standards E5 (SECS II), E30 (GEM), E87 (CMS), E39 (OSS), E40 (PMS), E90 (STS), and E94 (CJM).

Parallel test capability

4080 series testers support both synchronous and asynchronous parallel test. Keysight SPECS and SPECS-FA support a powerful virtual multiple testhead technology that enables separate measurement threads to run completely independently of one another.
This eliminates measurement "dead time" (time spent waiting for other measurement threads to complete) and maximizes throughput.

General Specifications

Operating and storage requirements		
Temperature range	Operating	5°C to 30°C (no condensation)
	Storage	–20°C to 50°C –20°C to 60 °C (for an unpacked system)
Humidity range	Operating	15% to 70% (no condensation)
	Storage	< 80% RH (no condensation) < 90% RH, < 12 hrs (for an unpacked system)
Power requirement		
Nominal line voltage[1]	Allowable voltage range	Required maximum current
200 Vac	180 - 220 Vac	30 A
208 Vac	188 - 228 Vac	24 A
220 Vac	198 - 242 Vac	30 A
240 Vac	216 - 252 Vac	30 A
Regulatory and standard compliance		
EMC	EMC Directive (2004/108/EC) EN 61326-1 ICES/NMB-001 AS/NZS CISPR 11	
Safety	Low Voltage Directive (2006/95/EC) IEC 61010-1:2001/EN 61010-1:2001 CAN/CSA-C22.2 No. 61010-1-04, C/US SEMI S2-0703/S8-1103	
Certifications	CE, CSA C/US, C-tick, ICES/NMB-001	
Dimensions		
System cabinet	294 kg (including 3458A, SPGU with 5 x HV-SPGU, system controller)	
Test head	166 kg (including 7 MPSMUs, 1 HPSMU, 1 HS-CMU, 48 pins, HF matrix, RF matrix, manipulator extension shelf and PNA (E8363C) with enclosure, fan, and duct)	
Supported probers and recommended probe cards[2]		
Prober	TEL P12XL and Precio	
	ACCRETECH UF3000 and UF3000EX	
Probe card[2]	JEM (Japan Electronic Material)	
	MJC (Micronics Japan Co.)	
	SV Probe	
	FormFactor	

1. Line frequency must be 48 Hz to 63 Hz.
2. Please contact your local sales representative regarding the latest information on recommended probers and probe cards.

Recommended Conditions for Ultra-Low Current and Low Voltage Measurements[1]

In addition to the conditions listed in general specifications, Keysight Technologies recommends that the following additional conditions be satisfied for measuring precise low current and low voltage with the 4082A.

Recommended conditions for ultra-low current and low voltage measurements	
Probe cards[2]	JEM and MJC
Temperature	Within ±1°C after calibration
Temperature change period	≥ 10 minutes
Humidity	≤ 50%
Warm up time	≥ 60 minutes
Floor vibration	≤ 1 mG
Floor vibration frequency	≥ 10 Hz
Air cleanliness	≤ class 10,000
Line voltage	Burst noise ≤ 1 kV Surge noise ≤ 1 kV This line voltage environment applies EN61326–1

1. The information is this section applies only to systems configured with ultra-low current matrix cards and a high-resolution SMU.
2. Please contact your local sales representative regarding the latest information on recommended probers and probe cards.

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