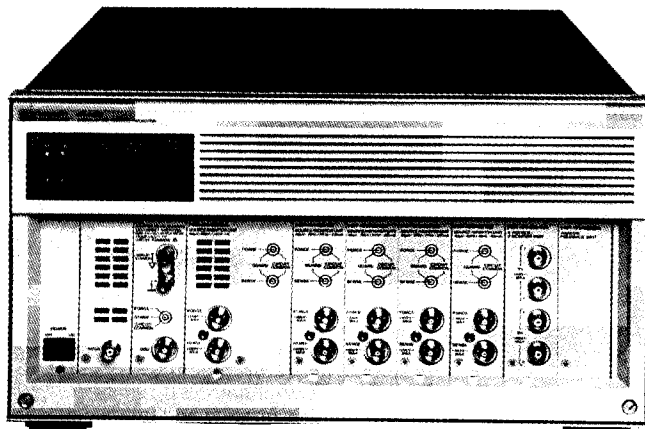


SEMICONDUCTOR TEST SYSTEMS

Modular dc Source/Monitor

HP 4142B

- Flexible, modular architecture
- Wide measurement range with high resolution
V: $\pm 4 \mu\text{V}$ to $\pm 1000 \text{ V}$, 0.05%
I: $\pm 20 \text{ fA}$ to $\pm 10 \text{ A}$, 0.2%
- Pulse measurement capabilities
Pulse width 1 ms to 50 ms, 100 μs resolution



HP 4142B



HP 4142B Modular dc Source/Monitor

Offering a wide measurement range and excellent sensitivity, the HP 4142B modular dc source/monitor is a system-use dc measurement instrument especially designed for high-throughput dc semiconductor testers. A completely user-definable system component, the HP 4142B features modular architecture that allows you to build a custom configuration to suit your measurement needs.

Eight plug-in module slots can accommodate any combination of the 5 presently available modules; as new modules become available, you can upgrade your measurement capabilities with ease. Choose from 2 types of source/monitor units (SMUs) to force or measure up to $\pm 200 \text{ V}$ and $\pm 1 \text{ A}$; a high current source/monitor unit (HCU) up to $\pm 10 \text{ A}$; a high voltage source/monitor unit (HVU) up to $\pm 1000 \text{ V}$, a voltage source/voltage monitor unit (VS/VMU), and an analog feedback unit (AFU). The HP 4142B's instrument command and measurement data-storage capabilities, coupled with the high-speed HP-IB interface, minimize computer loading, enhance throughput, and simplify systemization.

Versatile SMUs and Reliable Measurement

For general-purpose dc or pulsed measurement, use the HP 4142B source monitor unit. The equivalent of 4 instruments, this precision module forces voltage up to $\pm 100 \text{ V}$ and simultaneously measures currents down to 20 fA. It can also force currents up to $\pm 100 \text{ mA}$ while measuring voltage down to 40 μV .

If you test high-power components or desire a wider measurement range, use the HP 41420A source monitor unit. This versatile SMU can source $\pm 200 \text{ V}$ or ± 1 (14 W, dc or pulsed) and still maintain a measurement resolution of 40 μV and 20 fA. Both SMU's include a compliance feature that limits output voltage, current, or power to prevent damage to your device. Each SMU (HP 41420A or HP 41421B) acts as either a voltage source/current monitor or current source/voltage monitor. These complementary operating modes let you change the stimulus on a device without modifying the physical connections. This versatility reduces test time and eliminates instabilities caused by changing connections at the DUT.

- High-speed measurement (typical)
Sourcing or monitoring: 4 ms
V_{th}, hFE extracting: 12 ms
- Internal memory
Program memory: > 2000 commands (typical)
Data memory: 4004 measurement points

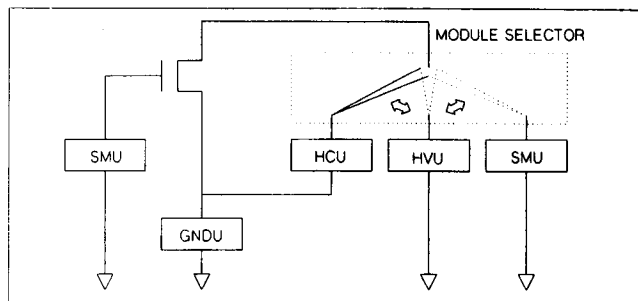
Test Power Devices to 10 A and 1000 V

The HP 41422A HCU and the HP 41423A HVU expand the measurement range of the HP 4142B to 10 A and 1000 V. They dramatically expand the HP 4142B's ability to test power devices, such as power transistors, power MOSFETs, GaAs FETs, and smart ICs. Using a combination of the two units, measurements of up to 20 A and 2000 V are possible.

Using the HCU, fast pulse testing (100 μs minimum pulse width) at high current increases test reliability by minimizing the effects of thermal drift.

Quasi-pulsed measurements by the HVU are effective for measuring breakdown voltage by minimizing the duration of the breakdown condition.

The HP 16087A module selector is a scanner that lets you remotely control the connection of the HP 41420A/41421B SMUs, the HP 41422A HCU, or the HP 41423A HVU to a test pin. It contributes to automatic testing for high-power devices with high breakdown voltage. The built-in module selector can be specified as an option of the HP 16088B test fixture.

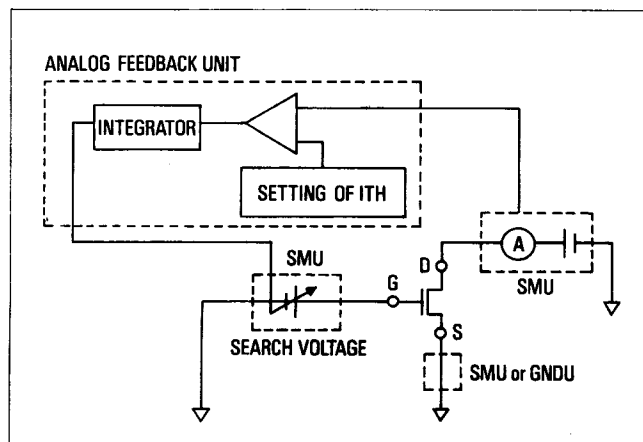


High-Speed Parameter Extraction by Analog Feedback Technique

To find important parameters that are specified at a given voltage or current, such as V_t or hFE, connect the HP 41425A AFU to 2 SMUs. The AFU modulates the output voltage of one SMU while monitoring the current or voltage of the other. Target currents and voltage are found with great speed (12 ms). This unique analog feedback network rapidly measures V_t, hFE, ΔL , or ΔW ; parameters that would require excessive test time on other parametric testers.

You can also use the AFU to bias and test microwave devices. It can be integrated into the network analyzer system.

By using the AFU, you can eliminate the effect of device thermal drift and can hold the initial setting bias for ac measurement time.



Specifications

4142B Modular dc Source Monitor

Ground Unit (GNDU):

Use as measurement ground
0 V, Kelvin connection

Offset voltage: $\pm 500 \mu\text{V}$ max

Current voltage: $\pm 1.6 \text{ A}$

Maximum cable resistance:

FORCE terminal: $\leq 1 \Omega^*$

SENSE terminal: $\leq 10 \Omega^*$

Maximum capacitive load: $10 \mu\text{F}$ max*

Spot Measurements: Source and monitor DC current or voltage

Sweep Measurements:

- One channel can sweep current or voltage while up to 8 channels measure current or voltage

- A second sweep channel can be slaved to the first sweep channel (dual synchronous sweep)

Sweep modes: Linear or logarithmic

Single or double staircase

Sweep parameters: Start, stop, number of steps, or steps per decade

Maximum number of steps: 1000

Hold time: 0 to 655.35 s, 10 ms resolution

Delay time: 0 to 65.535 s, 1 ms resolution

Setting accuracy: $0.5\% + 1 \text{ ms}^*$

Measurement Unit

HP 4142B Modules

Model number	Slots req'd	Voltage range	Current range	Measurement resolution	Accuracy	
					V	I
HP 41420A SMU ¹	2	$\pm 100 \mu\text{V}$ to $\pm 200 \text{ V}$	$\pm 50 \text{ IA}$ to $\pm 1 \text{ A}$	$40 \mu\text{V}$ 20 fA	0.05%	0.2%
HP 41421B SMU ¹	1	$\pm 100 \mu\text{V}$ to $\pm 100 \text{ V}$	$\pm 50 \text{ IA}$ to $\pm 100 \text{ mA}$	$40 \mu\text{V}$ 20 fA	0.05%	0.2%
HP 41422A HCU ¹	2	$\pm 200 \mu\text{V}$ to $\pm 10 \text{ V}$	$\pm 500 \mu\text{A}$ to $\pm 10 \text{ A}$	$40 \mu\text{V}$ 20 μA	0.5%	0.5%
HP 41423A HVU	2	$\pm 10 \text{ mV}$ to $\pm 1000 \text{ V}$	$\pm 50 \text{ pA}$ to $\pm 10 \text{ mA}$	2 mV 2 pA	0.5%	1%
HP 41424A VS/MMU	1	$\pm 1 \text{ mV}$ to $\pm 40 \text{ V}$	$\pm 20 \text{ mA}$ to $\pm 100 \text{ mA}$	$4 \mu\text{V}$ 20 μA	0.05%	3%
HP 41425A AFU	1	Searches for a specified current or voltage on one SMU by controlling the voltage output of another SMU.				

¹ Provides Kelvin connections (remote sensing).

² Differential measurement mode ($40 \mu\text{V}$ resolution in normal mode).

SMU Range, Resolution and Accuracy (at 18° to 28° C)

Voltage range	Set res.	Meas. res.	Accuracy	Max. current
$\pm 2 \text{ V}$	100 μV	40 μV	$\pm 0.05\% \pm 1 \text{ mV}$	1 A
$\pm 20 \text{ V}$	1 mV	400 μV	$\pm 0.05\% \pm 10 \text{ mV}$	1 A ($V \leq 14 \text{ V}$) 0.7 A ($V > 14 \text{ V}$)
$\pm 40 \text{ V}$	2 mV	800 μV	$\pm 0.05\% \pm 20 \text{ mV}$	350 mA
$\pm 100 \text{ V}$	5 mV	2 mV	$\pm 0.05\% \pm 50 \text{ mV}$	125 mA
$\pm 200 \text{ V}$	10 mV	4 mV	$\pm 0.05\% \pm 100 \text{ mV}$	50 mA

Current range	Set res.	Meas. res.	Accuracy	Max. voltage
$\pm 1 \text{ nA}$	50 fA	20 fA	$\pm 1\% \pm (0.1 + 0.2 \times \text{Vo}/100)\% \pm 5 \text{ pA}$	200 V
$\pm 10 \text{ nA}$	500 fA	200 fA	$\pm 0.5\% \pm (0.1 \times 0.2 \times \text{Vo}/100)\%$	
$\pm 100 \text{ nA}$	5 pA	2 pA		
$\pm 1 \mu\text{A}$	50 pA	20 pA	$\pm 0.2\% \pm (0.1 + 0.2 \times \text{Vo}/100)\%$	
$\pm 10 \mu\text{A}$	500 pA	200 pA		
$\pm 100 \mu\text{A}$	5 nA	2 nA		
$\pm 1 \text{ mA}$	50 nA	20 nA		
$\pm 10 \text{ mA}$	500 nA	200 nA	$\pm 0.5\% \pm (0.1 + 0.2 \times \text{Vo}/100)\%$	200 V ($I < 50 \text{ mA}$)
$\pm 100 \text{ mA}$	5 μA	2 μA		100 V ($I > 50 \text{ mA}$)
$\pm 1 \text{ A}$	50 μA	20 μA		200 V ($I \leq 50 \text{ mA}$)
				100 V (125 mA $\leq I < 50 \text{ mA}$)
			40 V (350 mA $\leq I < 125 \text{ mA}$)	
				20 V (0.7 A $\leq I < 350 \text{ mA}$)
				14 V ($I > 0.7 \text{ A}$)

* Note: Vo is the SMU output voltage, in volts.

Pulsed Measurements (SMU)

Force and measure pulsed current or voltage

Ranges: 2 V range: 10 nA to 1 A range

20 V to 200 V range: 100 μA to 1 A range

V pulse: 2 V range: 1 compliance $\geq 2 \text{ nA}$

20 V to 200 V range: 1 compliance $\geq 20 \mu\text{A}$

I pulse: 10 nA to 10 μA range: V compliance $\leq 2 \text{ V}$

100 μA to 1 A range: V compliance $\leq 200 \text{ V}$

Pulse width: 1 to 50 ms, 100 μs resolution

Pulse period: 10 to 500 ms, 100 μs resolution

Setting accuracy: $0.5\% + 100 \mu\text{s}^*$

Pulsed Sweeps

- Sweep and measure pulsed current or voltage
- Sweep dc current or voltage while pulsing current or voltage. Use Pulse and Sweep specification

Memory

Program memory: Stores approximately 2000* HP-IB commands, which can be grouped into 99 subroutines.

Data memory: 4004 measurement points (binary)
1001 points (ASCII format)

General Specifications

Auto Calibration: Automatically calibrates the offset errors in each measurement unit every 30 minutes*

Environmental Information

Operating temperature: 5° to 40° C

Allowable temperature drift: $\pm 3^\circ \text{ C}^*$

Operating humidity: 5% to 80% RH

Storage temperature: -40° to 65° C

Storage humidity (at 65° C): $\leq 90\% \text{ RH}$

Operating inclination: $\pm 20^\circ$ from horizontal

Power: 100/120/220 V, $\pm 10\%$; 240 V $10\% + 5\%$; 48 to 66 Hz, 750 VA max.

Size: 426 mm W \times 235 mm H \times 676 mm D

Weight

HP 4142B: Approximately 23 kg

HP 41420A/41422A/41423A: Approximately 3 kg

HP 4142B/41424A/41425A: Approximately 2 kg

Recommended Computer

HP 9000 Series 300

BASIC operating system (Version 3.0 or later)

Software

Parameter measurement library: Current Gain, Breakdown Voltage (2), Drain Current, Threshold Voltage (3), and Resistance

Test instruction set: Initialize, Force, Measure, Pulse, Graphics, and Data Storage

* Reference data only.

Ordering Information

	Price
HP 4142B Modular dc Source/Monitor	\$12,100
Opt 300 Install Control Unit for Module Selector	\$430
Opt 302/303 Control Cable	\$130/110
Opt 400 Install 41420A (needs 2 slots)	\$4,730
Opt 402/403 Quadaxial Cable for 41420A	\$600/500
Opt 410 Install 41421B (needs 1 slot)	\$3,910
Opt 412/413 Quadaxial Cable for 41421B	\$600/500
Opt 420 Install 41422 A (needs 2 slots)	\$5,000
Opt 422/423 Dual Coaxial Cable for 41422A	\$540/490
Opt 430 Install 41423A (needs 2 slots)	\$6,500
Opt 432/433 Triaxial/BNC Cable for 41423A	\$580/510
Opt 440 Install 41424A (needs 1 slot)	\$3,560
Opt 442/443 Coaxial Cable for 41424A	\$340/320
Opt 450 Install 41425A (needs 1 slot)	\$1,900
HP 41420A Source/Monitor Unit	\$4,730
Opt 402/403 Quadaxial Cable	\$600/500
HP 41421B Source/Monitor Unit	\$3,910
Opt 412/413 Quadaxial Cable	\$600/500
HP 41422A High-Current Source/Monitor Unit	\$5,000
Opt 422/423 Dual Coaxial Cable	\$540/490
HP 41423A High-Voltage Source/Monitor Unit	\$6,500
Opt 432/433 Triaxial/BNC Cable	\$580/510
HP 41424A Voltage Source/Voltage Monitor Unit	\$3,560
Opt 442/443 Coaxial Cable	\$340/320
HP 41425A Analog Feedback Unit	\$1,900
HP 16087A Module Selector	\$1,300
HP 16088B Test Fixture	\$4,300
Opt 010 Module Set for Power Devices	\$690
Opt 300 Add Module Selector	\$650