Specifications

HP 4142B Mainframe

Chassis

8 slots for plug-in measurement units.
No more than one HP 41425A Analog Feedback Unit per mainframe.
Maximum Common to Ground Voltage: ±42V.

Supported Plug-in Measurement Units

Model Number	Number of Slots Occupied	Range of Operation*
HP 41420A HPSMU	2	40μV to 200V, 20fA to 1A
HP 41421B MPSMU	1	40μV to 100V, 20fA to 100mA
HP 41422A HCU	2	40μV to 10V, 20nA to 10A
HP 41423A HVU	2	2mV to 1000V, 2pA to 10mA
HP 41424A VS/VMU	1	4μV to 40V, 20μA to 100mA
HP 41425A AFU	1	Used with two SMUs to make analog voltage/current searches

* 2000V max using two HVUs or 20A (pulsed) using two HCUs

Maximum Output Power

The sum of all measurement unit's instantaneous output power (product of Voltage Range and Current Output or Current Compliance) cannot exceed 32W. Each unit can be switched off to consume 0W power when in standby (power save) mode.

Unit	Instantaneous Output Power
HP 41420A HPSMU	Vrange x I_O (or I_C)[1]
HP 41421B MPSMU	
HP 41422A HCU	10W + 20V x I_O (or I_C) x duty cycle[2]
HP 41423A HVU	10W + V_O (or V_C) x I_C (or I_O)
HP 41424A VS/VMU	2.2W (20V range) for each VS 0.88W (40V range) for each VS
HP 41425A AFU	0W
GNDU SMU	0W

V_O: V output set, V_C: V compliance, I_O: I output set, I_C: I compliance
[1]2V range is calculated as 20V for the HP 41420A and HP 41421B
[2]Max pulse duty cycle: 1mA–1A range:10% 10A range:1%

Ground Unit (GNDU)

The GNDU is part of the HP 4142B mainframe. It is configured as a high current SMU set to 0 Volts. Used as measurement ground.

Connection:	0 Volt, Kelvin
Maximum offset voltage:	±500μV
Current range:	±1.6A
Maximum cable resistance	
FORCE terminal:	≤1Ω
SENSE terminal:	≤10Ω
Maximum capacitive load:	10μF

Control Unit (CTLU)

The control unit provides two functions. It controls the HP 16087A 3-input module selector, and provides a general purpose 16-bit TTL output (open collector) for extended system functions. Intended use of the TTL output is for external relay control and/or setting of test device internal settings.

Module Selector Relay Control Reference Data

Output voltage:	24V
Current limit:	30mA
Typical control speed:	30msec

16-Bit Relay Control Reference Data

Maximum voltage:	20V
Saturation voltage:	0.7V (at sink current = 50mA)
Pull-up voltage/resistor:	4.5V/10kΩ
Typical control speed:	10ms

Memory

The HP 4142B mainframe contains two types of memory which increase test speed. The program memory allows high-speed testing of multiple devices without the need to communicate over the HP-IB interface. The data memory collects and sends spot or swept data efficiently over the HP-IB interface.

Program memory:	Stores appox. 2000 program steps, which can be grouped into 99 subroutines.
Data memory:	Maximum of 4095 data values (binary) Maximum of 1023 data values (ASCII)

Interfaces

External trigger input:	TTL level negative logic
Minimum pulse width:	100μsec
External trigger output:	TTL level negative logic
Approx pulse width:	100μsec
HP-IB interface:	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1.

General Reference

Self-Test
At power-up the HP 4142B checks the operation of its own operational status. The self-test can be performed at any time via HP-IB.

Auto-Calibration
The offset errors in each measurement unit are automatically calibrated every 30 minutes.

Environmental Information

Operating temperature:	5°C to 40°C
Allowable temperature drift:	±3°C (after auto-calibration)
Operating humidity:	5% to 80% RH
Storage temperature:	−40°C to 65°C
Storage humidity:	≤90% RH at 65°C
Operating inclination:	±20° from horizontal

Power requirements

100/120/220V:	±10%
240V:	−10% to +5%
Maximum VA:	750 (48–66 Hz)

Dimensions
426mm W by 235mm H by 676mm D

Weight (approx.)

HP 4142B mainframe:	23kg	HP 41423A:	3kg
HP 41420A:	3kg	HP 41424A:	2kg
HP 41421B:	2kg	HP 41425A:	2kg
HP 41422A:	2kg		

Reference Data for HP 4142B

Recommended Computer

Consult the HP 4142B configuration, guide Lit. no 5091-0634E, for computers supported on each of the following three platforms:

BASIC operating system on HP 9000 Series 300 workstations
BASIC/UX operating system on HP 9000 Series 300 workstations
BASIC/MS-DOS operating system on HP Vectra or IBM compatible PCs

Software

Included with the HP 4142B
Parameter Measurement Library: Resistance, MOS, and bipolar transistor algorithm sets
Test Instruction Set: Initialize, Force, Measure, Pulse, Sweep, Graphics, and Data Storage.

Additional software
HP IMA (Interactive Measurement and Analysis) WS, UX, or PC
HP ITG (Interactive Test Generator) WS, UX, or PC
HP IC-CAP (Integrated Circuit Characterization and Analysis Program) UX

Specifications

Typical Measurement Times
HP 9000 Series 332 computer.
ASCII data transfer time is included.

HP 41420A/HP 41421B SMU
(20V/100mA range, spot measurement)
Force I or V: 3.5msec
Measure I or V: 4.0msec

HP 41425A AFU
V_T at I_0 = 1μA: 12msec

HP-IB Data Transfer Rate
ASCII format: 1300μsec/point
Binary format: 450μsec/point

Measurement Accuracy
Is specified at front panel connector terminals, referenced to SMU common, under the following conditions:

1. 23 °C ±5 °C
2. 40 minute warm-up period
3. Auto Calibration enabled
4. Kelvin connection

HP 41420A High Power Source/Monitor Unit

The HP 41420A HPSMU occupies two slots in the HP 4142B mainframe. It sources voltage and monitors current, or sources current and monitors voltage. Separate FORCE and SENSE terminals enable Kelvin connections (remote sensing).

Output/Measurement Range, Resolution and Accuracy.

Voltage Range	Set. Resolution	Meas. Resolution	Accuracy	Maximum Current
±2V	100μV	40μV	±(0.05% + 1mV)	±1A
±20V	1mV	400μV	±(0.05% + 10mV)	±1A (|V|≤14V) ±0.7A (|V|>14V)
±40V	2mV	800μV	±(0.05% + 20mV)	±350mA
±100V	5mV	2mV	±(0.05% + 50mV)	±125mA
±200V	10mV	4mV	±(0.05% + 100mV)	±50mA

Current Range	Set. Resolution	Meas. Resolution	Accuracy	Maximum Voltage
±1nA	50fA	20fA	±(1% + 6pA + 20fA × V_{OUT})	±200V
±10nA	500fA	200fA	±(1% + 15pA + 200fA × V_{OUT})	
±100nA	5pA	2pA	±(0.5% + 100pA + 2pA × V_{OUT})	
±1μA	50pA	20pA	±(0.5% + 1nA + 20pA × V_{OUT})	
±10μA	500pA	200pA	±(0.2% + 10nA + 200pA × V_{OUT})	
±100μA	5nA	2nA	±(0.2% + 100nA + 2nA × V_{OUT})	
±1mA	50nA	20nA	±(0.2% + 1μA + 20nA × V_{OUT})	
±10mA	500nA	200nA	±(0.2% + 10μA + 200nA × V_{OUT})	
±100mA	5μA	2μA	±(0.2% + 100μA + 2μA × V_{OUT})	±200V (|I|≤50mA) ±100V (|I|>50mA)
±1A	50μA	20μA	±(0.5% + 1mA + 20μA × V_{OUT})	±200V (|I|<50mA) ±100V (125mA≥|I|>50mA) ±40V (350mA≥|I|>125mA) ±20V (0.7A ≥|I|>350mA) ±14V (|I|>0.7A)

Note: V_{OUT} is the SMU output voltage in volts.

Voltage/Current Compliance
The SMU can limit output voltage or current to prevent damage to a device under test.

Compliance voltage and current resolutions are the same as the Setting Resolutions in the table above, however the maximum compliance current resolution is 1pA. The Accuracy specifications, listed in the above table, apply also to the accuracy of compliance settings.

Current Over-range
1nA–100mA range: 15% of range
1A range: 0%

Reference Data for HP 41420A

Maximum capacitive load: 1000pF
Maximum guard capacitance: 900pF
Maximum shield capacitance: 5000pF
Maximum cable resistance
FORCE terminal: 10Ω (100mA)
0.7Ω (1A)
SENSE terminal: 10Ω
Typical voltage source output resistance/current measurement input resistance (non-Kelvin connection): 0.2Ω
Typical voltage measurement input resistance/current source output resistance: ≥10^{12}Ω
Guard offset voltage: ± 1mV
Noise (typical)
(20V range, 10μA or above)
Voltage source: 0.005% of V range (rms)
Current source: 0.005% of I range (rms)
Voltage monitor: 0.01% of V range (p-p)
Current monitor: 0.05% of I range (p-p)
Output overshoot (typical)
Voltage source: 0.03% of V range
Current source: 0.03% of I range
Typical range switching transient noise
Voltage ranging: 250mV
Current ranging: 10mV
Maximum slew rate: .2V/μsec

HP 41421B Medium Power Source/Monitor Unit

The HP 41421B MPSMU requires one slot in the HP 4142B mainframe. It sources voltage and monitors current, or sources current and monitors voltage. Separate FORCE and SENSE terminals enable Kelvin connections (remote sensing).

Output/Measurement Range, Resolution and Accuracy.

Voltage Range	Set. Resolution	Meas. Resolution	Accuracy	Maximum Current
±2V	100μV	40μV	±(0.05% + 1mV)	±100mA
±20V	1mV	400μV	±(0.05% + 10mV)	
±40V	2mV	800uV	±(0.05% + 20mV)	±50mA
±100V	5mV	2mV	±(0.05% + 50mV)	±20mA

Current Range	Set. Resolution	Meas. Resolution	Accuracy	Maximum Voltage
±1nA	50fA	20fA	±(1% + 6pA + 20fA × V_{OUT})	±100V
±10nA	500fA	200fA	+(1% + 15pA + 200fA × V_{OUT})	
±100nA	5pA	2pA	±(0.5% + 100pA + 2pA × V_{OUT})	
±1μA	50pA	20pA	±(0.5% + 1nA + 20pA × V_{OUT})	
±10μA	500pA	200pA	±(0.2% + 10nA + 200pA × V_{OUT})	
±100μA	5nA	2nA	±(0.2% + 100nA + 2nA × V_{OUT})	
±1mA	50nA	20nA	±(0.2% + 1μA + 20nA × V_{OUT})	
±10mA	500nA	200nA	±(0.2% + 10μA + 200nA × V_{OUT})	
±100mA	5μA	2μA	±(0.2% + 100μA + 2μA × V_{OUT})	±100V (|I|≤20mA) ±40V (50mA≥|I|>20mA) ±20V (|I|>50mA)

Note: V_{OUT} is the SMU output voltage in volts.