6.5 Digit Multimeter Hi-Accuracy, C-Size HP E1410A

Technical Specifications

- **Vdc/ac, 2- & 4-wire Ohm**
- **Noise rejection with long integration times/ guarding**
- **Quality measurements with high common mode rejection**
- **True RMS from 20 Hz to 1 MHz**
- **Software calibration**

Description

The HP E1410A 6.5-Digit Multimeter is a **C-size, 1-slot, message-based VXI module.** It offers DC voltage and resistance measurements at rates over 1,450 readings/s in the 3.5-digit mode or normal mode rejection of up to 90 dB in the 6.5-digit mode. You can measure true RMS AC signals from 20 Hz to 1 MHz with programmable settling times. Offset compensated ohms allows for quality resistance measurements by eliminating the effect of small series voltage offsets. Resolution, accuracy, and noises rejection may be set to optimize measurements speed. Extensive triggering is available.

Refer to the HP Website directory of addresses (URLs) for instrument driver availability and downloading instructions.

Accuracy

Choose the resolution, accuracy, and noise rejection you need. Fast function-range changes allow you to optimize measurement speeds. For low-level signals, long integration times and the system guard yield the most accurate measurements possible. Integration times from 100 power line cycles to 0.0005 power line cycles are selectable for all functions. Resolution from 6.5 to 3.5 digits is selectable as a function of integration time.

Flexible Triggering

The DMM has extensive triggering capabilities, including synchronization with external devices. You can access the external trigger and voltmeter complete signals from the front panel or VXIbus (TTL trigger lines).

Specifications

Reading Rate/Resolution

Max. reading rate: 1.45 k

Auto zero off, fixed range, delay 0, AC slow filter on, and offset compensation off.

Typical Reading Rates (rdgs/s)

	Aperture									
	2.0 s	**1.67 s**	**200 ms**	**167 ms**	**20 ms**	**16.7 ms**	**2.0 ms**	**1.67 ms**	**100 µs**	**10 µs**
DC voltage	0.4	0.49	4.0	4.9	47	56	312	360	1250	1450
Four-wire resistance	0.4	0.49	4.0	4.9	47	56	312	360	1250	1450
AC voltage	0.17	0.2	0.65	0.7	1.0	1.0	1.0	1.0	1.0	1.0

Resolution (bits/digits)

	Aperture									
	2.0 s	**1.67 s**	**200 ms**	**167 ms**	**20 ms**	**16.7 ms**	**2.0 ms**	**1.67 ms**	**100 µs**	**10 µs**
Binary bits:	±21.5	±21.5	±21.5	±21.5	±21.5	±21.5	±18.2	±18.2	±14.9	±11.5
Decimal digits:	6.5	6.5	6.5	6.5	6.5	6.5	5.5	5.5	4.5	3.5

Noise Rejection (dB)

Noise Rejection Conditions: 1 kΩ imbalance in low lead. NMR is for specified frequencies ± 0.08%.

DC voltage & resistance

		2.0 s	**1.67 s**	**200 ms**	**167 ms**	**20 ms**	**16.7 ms**	**2.0 ms**	**1.67 ms**	**100 µs**	**10 µs**
DC Common mode rejection		140 dB	140 dB	140 dB	140 dB	140 dB	140 dB	140 dB	140 dB	140 dB	140 dB
50Hz	**Power line cycles**	100	—	10	—	1	—	—	—	—	—
Normal mode (50 Hz) rejection		90 dB	0 dB	80 dB	0 dB	60 dB	0 dB	0 dB	0 dB	0 dB	0 dB
60Hz	**Power line cycles**	—	100	—	10	—	1	—	—	—	—
Normal mode (60 Hz) rejection		0 dB	90 dB	0 dB	80 dB	0 dB	60 dB	0 dB	0 dB	0 dB	0 dB
400Hz	**Power line cycles**	800	—	80	—	8	—	—	—	—	—
Normal mode (400Hz) rejection		90 dB	0 dB	80 dB	0 dB	60 dB	0 dB	0 dB	0 dB	0 dB	0 dB

AC voltage

	2.0 s	**1.67 s**	**200 ms**	**167 ms**	**20 ms**	**16.7 ms**	**2.0 ms**	**1.67 ms**	**100 µs**	**10 µs**
DC to 60Hz Common mode rejection	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB	>86 dB

DC Voltage Resolution/Accuracy

Accuracy Conditions: Auto-zero on. One hour warmup. Temperature within ±5 °C of temperature at calibration (module calibrated at 18-28 °C).

Range	**Input Resistance**	**Resolution vs Aperture (Volts)**		**90-Day Accuracy vs Aperture ± (% of Reading + Volts)**	
		20/16.7 ms	**10 µs**	**20/16.7 ms**	**10 µs**
30 mV	>10 GΩ	10 nV	10 µV	0.0040% +3.9 µV	0.0040% +60 µV
300 mV	>10 GΩ	100 nV	100 µv	0.0025% +4.0 µV	0.0025% +400 µV
3 V	>10 GΩ	1 µv	1 mV	0.0017% +9.0 µV	0.0017% +4.0 mV
30 V	10 MΩ ±1%	10 µv	10 mV	0.0035% +200 µV	0.0035% +40 mV
300 V	10 MΩ ±1%	100 µv	100 mV	0.0063% +700 µV	0.0050% + 400 mV

DC voltage: 300 V
Voltage accuracy (DC): 0.002%

Four Wire Resistance

Accuracy conditions: Auto-zero on, one hour warmup. On 300 MΩ and 3 GΩ ranges, specification applies to two-wire Ω only, with inputs >10% of full scale and within 24 hrs of internal calibration. Temperature within ±5 °C of temperature at calibration (module calibrated at 18-28 °C).

Range	Source Current	Maximum Open Circuit Voltage	Resolution vs Aperture (Volts)		90-Day Accuracy vs Aperture ± (% of reading + Ω)	
			20/16.7 ms	10 μs	20/16.7 ms	10 μs
30 Ω	1 mA	12 V	10 μΩ	10 mΩ	0.0065% + 4.5 mΩ	0.0065% + 60 mΩ
300 Ω	1 mA	12 V	100 μΩ	100 mΩ	0.0045% + 4.5 mΩ	0.0045% + 400 mΩ
3 kΩ	1 mA	12 V	1 mΩ	1 Ω	0.0035% + 7 mΩ	0.0035% + 4 Ω
30 kΩ	100 μA	12 V	10 mΩ	10 Ω	0.0035% + 70 mΩ	0.0035% + 40 Ω
300 kΩ	10 μA	12 V	100 mΩ	100 Ω	0.0040% + 900 mΩ	0.0040% + 400 Ω
3 MΩ	1 μA	12 V	1 Ω	1 kΩ	0.0055% + 16 Ω	0.0055% + 5 kΩ
30 MΩ	100 nA	8.5 V	10 Ω	10 kΩ	0.0250% + 930 Ω	0.0250% + 50 kΩ
300 MΩ	100 nA	8.5 V	100 Ω	100 kΩ	1.6% + 100 kΩ	not specified
3 GΩ	100 nA	8.5 V	1 kΩ	1 MΩ	16% + 1 MΩ	not specified

2/4-wire Ω: 3 G Ω

True RMS AC Voltage (AC coupled)

Crest Factor: 3.5 at full scale. Accuracy Conditions: Sine wave inputs > 10% of full scale. DC component <10% of AC component. AC slow filter on. Auto-zero on. One hour warmup. Temperature within ±5 °C of temperature at calibration (module calibrated at 18-28 °C).

Range (RMS)	Input Impedance	Resolution Aperture = 20/16.7 ms	Frequency	90-Day Accuracy ± (% of reading + Volts) Aperture = 20/16.7 ms
30 mV	1 MΩ ±1%, < 90 pF	10 nV	20 Hz-45 Hz	0.58% + 37.3 μV
			45-100 Hz	0.23% + 37.3 μV
			100 Hz-20 kHz	0.15% + 37.3 μV
			20-100 kHz	0.68% + 47.1 μV
			100-300 kHz	3.35% + 123 μV
			300 kHz-1 MHz	10.35% + 691 μV
300 mV	1 MΩ ±1%, < 90 pF	100 nV	20-45 Hz	0.58% + 133 μV
			45-100 Hz	0.23% + 133 μV
			100 Hz-20 kHz	0.15% + 133 μV
			20-100 kHz	0.68% + 231 μV
			100-300 kHz	3.35% + 991 μV
			300 kHz-1 MHz	10.35% + 6.67 mV
3 V	1 MΩ ±1%,< 90 pF	1 μV	20-45 Hz	0.58% + 1.33 mV
			45-100 Hz	0.23% + 1.33 mV
			100 Hz-20 kHz	0.15% + 1.33 mV
			20-100 kHz	0.68% + 2.31 mV
			100-300 kHz	3.35% + 9.91 mV
			300 kHz-1 MHz	10.35% + 66.7 mV
30 V	1 MΩ ±1%, < 90 pF	10 μV	20-45 Hz	0.58% + 13.3 mV
			45-100 Hz	0.23% + 13.3 mV
			100 Hz-20 kHz	0.15% + 13.3 mV
			20-100 kHz	0.68% + 23.1 mV
			100-300 kHz	3.35% + 99.1 mV
			300 kHz-1 MHz	10.35% + 667 mV
300 V	1 MΩ ±1%, < 90 pF	100 μV	20-45 Hz	0.64% + 133 mV
			45-100 Hz	0.29% + 133 mV
			100 Hz-20 kHz	0.21% + 133 mV
			20-100 kHz	1.08% + 390 mV
			100 kHz-1 MHz	not specified

AC voltage: 300 V
Voltage accuracy (AC): 0.194%

Frequency and Period

Sensitivity (sinewave): 10 mV rms
Trigger level: Triggers and counts on zero crossings
Conditions: 0-55 °C.

Frequency Range	Period Range	1 Year Accuracy ± (% of Reading)
10-400 Hz	0.1-0.025 s	0.05%
400 Hz-1.5 MHz	0.025 s-667 ns	0.01%

Timing/Synchronization

Timer/pacer:
Timer range: 600 µs to 2100 s
Resolution: 1.0 µs
Programmable delay:
Delay range: 0 to 2100 s
Resolution: 1.0 µs
External trigger:
Trigger condition (programmable): negative or positive edge
Minimum pulse width: 10 ns

Memory

Reading storage: 4,096 readings
Multimeter state memory: 10 states

General

Functions

Idc: —
Iac: —
Frequency: 1.5 MHz
Period: 1 µs
Temp.: Tm, RTD

VXI Characteristics

VXI device type: Message-based
Size: C
Slots: 1
Connectors: P1/2
Shared memory: Yes
VXI busses: TTL Trigger Bus
C-size compatibility: Yes

Instrument Drivers

See the HP Website (http://www.hp.com/go/inst_drivers) for driver availability and downloading.

Command module firmware: n/a
Command module firmware rev: n/a
I-SCPI Win 3.1: n/a
I-SCPI Series 700: n/a
C-SCPI LynxOS: n/a
C-SCPI Series 700: n/a
HP VEE Drivers: Yes
VXI*plug&play* Win Framework: Yes
VXI*plug&play* Win95/NT Framework: No
VXI*plug&play* HP-UX Framework: No (not available at time of publication)

Module Current

	I_{PM}	I_{DM}
+5 V:	1	0.1
+12 V:	0.5	0.15
−12 V:	0	0
+24 V:	0	0
−24 V:	0	0
−5.2 V:	0	0
−2 V:	0	0

Cooling/Slot

Watts/slot: 11.00
ΔP mm H_2O: 0.15
Air Flow liter/s: 0.92

Ordering Information

Description	Product No.
6 ½ digit multimeter, high accuracy	HP E1410A
Service manual	HP E1410A 0B3
Mil std 45662A calibration w/ test data	HP E1410A 1BP
Japan - Japanese localization	HP E1410A ABJ
3 yr. retn. to HP to 1 yr. OnSite warr.	HP E1410A W01

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