

# 6.5-Digit Multimeter, High-Accuracy, C-Size HP E1410A Technical Specifications

- 1-Slot, C-size, message based
- Vdc/ac, 2- & 4-wire  $\Omega$
- 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. Temperature measurements using thermistors and RTDs are supported. Resolution, accuracy, and noise rejection may be set to optimize measurements speed. Extensive triggering is available.

Refer to the HP Website for instrument driver availability and downloading instructions, as well as for recent product updates, if applicable.



HP E1410A



## DC Voltage Resolution/Accuracy

Accuracy Conditions: Auto-zero on. One hour warmup. Temperature within  $\pm 5^\circ\text{C}$  of temperature at calibration (module calibrated at 18-28  $^\circ\text{C}$ ).

Range	Input Resistance	Resolution vs Aperture (Volts)		90-Day Accuracy vs Aperture $\pm$ (% of Reading + Volts)	
		20/16.7 ms	10 $\mu\text{s}$	20/16.7 ms	10 $\mu\text{s}$
30 mV	>10 G $\Omega$	10 nV	10 $\mu\text{V}$	0.0040% + 3.9 $\mu\text{V}$	0.0040% + 60 $\mu\text{V}$
300 mV	>10 G $\Omega$	100 nV	100 $\mu\text{V}$	0.0025% + 4.0 $\mu\text{V}$	0.0025% + 400 $\mu\text{V}$
3 V	>10 G $\Omega$	1 $\mu\text{V}$	1 mV	0.0017% + 9.0 $\mu\text{V}$	0.0017% + 4.0 mV
30 V	10 M $\Omega$ $\pm$ 1%	10 $\mu\text{V}$	10 mV	0.0035% + 200 $\mu\text{V}$	0.0035% + 40 mV
300 V	10 M $\Omega$ $\pm$ 1%	100 $\mu\text{V}$	100 mV	0.0063% + 700 $\mu\text{V}$	0.0050% + 400 mV
DC voltage:	300 V				
Voltage accuracy (DC):	0.002%				

## Four-Wire Resistance

Range	Source Current	Maximum Open Circuit Voltage	Resolution vs. Aperture (Volts)		90-Day Accuracy vs. Aperture $\pm$ (% of reading = $\Omega$ )	
			20/16.7 ms	10 $\mu\text{s}$	20/16.7 ms	10 $\mu\text{s}$
30 $\Omega$	1 mA	12 V	10 $\mu\Omega$	10 m $\Omega$	0.0065% + 4.5 m $\Omega$	0.0065% + 60 m $\Omega$
300 $\Omega$	1 mA	12 V	100 $\mu\Omega$	100 m $\Omega$	0.0045% + 4.5 m $\Omega$	0.0045% + 400 m $\Omega$
3 k $\Omega$	1 mA	12 V	1 m $\Omega$	1 $\Omega$	0.0035% + 7 m $\Omega$	0.0035% + 4 $\Omega$
30 k $\Omega$	100 $\mu\text{A}$	12 V	10 m $\Omega$	10 $\Omega$	0.0035% + 70 m $\Omega$	0.0035% + 40 $\Omega$
300 k $\Omega$	10 $\mu\text{A}$	12 V	100 m $\Omega$	100 $\Omega$	0.0040% + 900 m $\Omega$	0.0040% + 400 $\Omega$
3 M $\Omega$	1 $\mu\text{A}$	12 V	1 $\Omega$	1 k $\Omega$	0.0055% + 16 $\Omega$	0.0055% + 5 k $\Omega$
30 M $\Omega$	100 nA	8.5 V	10 $\Omega$	10 k $\Omega$	0.0250% + 930 $\Omega$	0.0250% + 50 k $\Omega$
300 M $\Omega$	100 nA	8.5 V	100 $\Omega$	100 k $\Omega$	1.6% + 100 k $\Omega$	not specified
3 G $\Omega$	100 nA	8.5 V	1 k $\Omega$	1 M $\Omega$	16% + 1 M $\Omega$	not specified

Accuracy conditions: Auto-zero on, one hour warmup. On 300 M $\Omega$  and 3 G $\Omega$  ranges, specification applies to two-wire  $\Omega$  only, with inputs >10% of full scale and within 24 hrs of internal calibration. Temperature within  $\pm 5^\circ\text{C}$  of temperature at calibration (module calibrated at 18-28  $^\circ\text{C}$ ).

2/4-wire  $\Omega$ : 3 G  $\Omega$

## 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  $\pm 5^\circ\text{C}$  of temperature at calibration (module calibrated at 18-28  $^\circ\text{C}$ ).

Range (RMS)	Input Impedance	Resolution Aperture = 20/16.7 ms	Frequency	90-Day Accuracy $\pm$ (% of reading + Volts) Aperture = 20/16.7 ms
30 mV	1 M $\Omega$ $\pm$ 1%, < 90 pF	10 nV	20 Hz-45 Hz	0.58% + 37.3 $\mu\text{V}$
			45-100 Hz	0.23% + 37.3 $\mu\text{V}$
			100 Hz-20 kHz	0.15% + 37.3 $\mu\text{V}$
			20-100 kHz	0.68% + 47.1 $\mu\text{V}$
			100-300 kHz	3.35% + 123 $\mu\text{V}$
			300 kHz-1 MHz	10.35% + 691 $\mu\text{V}$
300 mV	1 M $\Omega$ $\pm$ 1%, < 90 pF	100 nV	20-45 Hz	0.58% + 133 $\mu\text{V}$
			45-100 Hz	0.23% + 133 $\mu\text{V}$
			100 Hz-20 kHz	0.15% + 133 $\mu\text{V}$
			20-100 kHz	0.68% + 231 $\mu\text{V}$
			100-300 kHz	3.35% + 991 $\mu\text{V}$
			300 kHz-1 MHz	10.35% + 6.67 mV
3 V	1 M $\Omega$ $\pm$ 1%, < 90 pF	1 $\mu\text{V}$	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 M $\Omega$ $\pm$ 1%, < 90 pF	10 $\mu\text{V}$	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 M $\Omega$ $\pm$ 1%, < 90 pF	100 $\mu\text{V}$	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

### Functions

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

## General Specifications

### 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: n/a

### Instrument Drivers

See the HP Website ([http://www.hp.com/go/inst\\_drivers](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 Panel Drivers: Yes  
VXIplug&play Win Framework: Yes  
VXIplug&play Win 95/NT Framework: Yes  
VXIplug&play HP-UX Framework: No

### Module Current

	I <sub>PM</sub>	I <sub>DM</sub>
+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<sub>2</sub>O: 0.15  
Air Flow liter/s: 0.92

## Ordering Information

Description	Product No.
6.5-Digit Multimeter, High Accuracy Service Manual	HP E1410A
Mil Std 45662A Calibration w/Test Data	HP E1410A 0B3
Japan - Japanese Localization	HP E1410A 1BP
	HP E1410A ABJ
3 Yr. Retn. to HP to 1 Yr. OnSite Warr.	HP E1410A W01

---

**Related Literature**

*1998 Test System and VXI Products Data Book*,  
HP Pub. No. 5966-2812E

*1999 Test System and VXI Products Catalog*,  
HP Pub. No. 5968-3698

---

**Warranty**

Standard Hewlett-Packard VXIbus hardware products are warranted against defects in materials and workmanship for a period of three years unless otherwise noted. HP software and firmware products that are designated by HP for use with a hardware product, when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in materials and workmanship.

For a complete and detailed warranty statement please see the *HP Test System and VXI Products Data Book* or visit the HP Website at <http://www.hp.com/go/vxi>.

---

**Website Directory**

HP VXI Product Information  
<http://www.hp.com/go/vxi>

HP VXI Channel Partners  
<http://www.hp.com/go/vxichanpart>

HP VEE Application Website  
<http://www.hp.com/go/hpvee>

Data Acquisition and Control Website  
[http://www.hp.com/go/data\\_acq](http://www.hp.com/go/data_acq)

HP Instrument Driver Downloads  
[http://www.hp.com/go/inst\\_drivers](http://www.hp.com/go/inst_drivers)

Electronics Manufacturing Test Solutions  
<http://www.hp.com/go/manufacturing>

**For more information about Hewlett-Packard test & measurement products, applications, services, and for a current sales office listing, visit our website, <http://www.hp.com/go/tmdir>. You can also contact one of the following centers and ask for a test & measurement sales representative.**

**United States:**

Hewlett-Packard Company  
Test and Measurement Call Center  
P.O. Box 4026  
Englewood, CO 80155-4026  
1 800 452 4844

**Canada:**

Hewlett-Packard Canada Ltd.  
5150 Spectrum Way  
Mississauga, Ontario L4W 5G1  
(905) 206 4725

**Europe:**

Hewlett-Packard  
European Marketing Centre  
P.O. Box 999  
1180 AZ Amstelveen  
The Netherlands  
(31 20) 547 9900

**Japan:**

Hewlett-Packard Japan Ltd.  
Measurement Assistance Center  
9-1, Takakura-Cho, Hachioji-Shi,  
Tokyo 192, Japan  
Tel: (81) 426 56 7832  
Fax: (81) 426 56 7840

**Latin America:**

Hewlett-Packard  
Latin American Region Headquarters  
5200 Blue Lagoon Drive, 9th Floor  
Miami, Florida 33126  
U.S.A.  
Tel: (305) 267-4245  
(305) 267-4220  
Fax: (305) 267-4288

**Australia/New Zealand:**

Hewlett-Packard Australia Ltd.  
31-41 Joseph Street  
Blackburn, Victoria 3130  
Australia  
1 800 629 485

**Asia Pacific:**

Hewlett-Packard Asia Pacific Ltd.  
17-21/F Shell Tower, Times Square,  
1 Matheson Street, Causeway Bay,  
Hong Kong  
Tel: (852) 2599 7777  
Fax: (852) 2506 9285

Data Subject to Change  
Copyright © April 1999  
Hewlett-Packard Company  
HP Publication No.: 5965-5561E