Appendix A
E1326B/E1411B Multimeter Specifications

General Specifications

Reading Rate Conditions: Autozero off, fixed range, default trigger delay, offset comp off, Sample Source "TIMER' for rates > 15 readings/second.

	Aperture						
	320 ms	**267 ms**	**20 ms**	**16.7 ms**	**2.5 ms**	**100 µs**	**10 µs**
Typical Reading Rates (rdgs/sec)							
DC voltage	3	3.5	49	59	365	3125	13000
Four-wire resistance	3	3.5	49	59	365	3125	13000
AC voltage	1.3	1.4	1.9	1.9	1.9	1.9	1.9
Resolution (bits/digits)							
Binary bits	±22	±22	±20	±20	±18	±15	±14
Decimal digits	6.5	6.5	6	6	5.5	4.5	4
Noise Rejection (dB) for DC Voltage and Resistance Functions							
Noise Rejection Conditions: Common Mode Rejection (CMR) measured with 1kohms in both HIGH and LOW leads with a 10% imbalance, LOW connected to COMMON at source, measured with respect to earth ground. Normal Mode Rejection (NMR) is for specified frequencies ±0.1%.							
DC CMR	150 dB	150 dB	150 dB	150 dB	150 dB	150 dB	150 dB
AC CMR (DC-400Hz)	70 dB	70 dB	70 dB	70 dB	70 dB	70 dB	70 dB
50 Hz: Power line cycles (NPLCs)	16	--	1	--	--	--	--
Normal Mode Rejection	84 dB	0 dB	60 dB	0 dB	0 dB	0 dB	0 dB
Effective common mode rejection (ECMR)*	154 dB	70 dB	130 dB	70 dB	70 dB	70 dB	70 dB
60 Hz: Power line cycles (NPLCs)	--	16	--	1	--	--	--
Normal Mode Rejection	0 dB	84 dB	0 dB	60 dB	0 dB	0 dB	0 dB
ECMR*	70 dB	154 dB	70 dB	130 dB	70 dB	70 dB	70 dB
400 Hz: Power line cycles (NPLCs)	128	--	8	--	1	--	--
Normal Mode Rejection	84 dB	0 dB	84 dB	0 dB	60 dB	0 dB	0 dB
ECMR*	154 dB	70 dB	154 dB	70 dB	130 dB	70 dB	70 dB

*64 and 300 volt ranges reduced by 36 dB

Input Characteristics: Maximum Nondestructive Input (volts)

Terminals	**DC**	**AC RMS**	**AC Peak**
Hi to lo	300	300	450
Hi to common	300	300	450
Hi to chassis	300	300	450
Lo to common	15	10	15
Lo to chassis	300	300	450
Common to chassis	300	300	450

Input amplifier bandwidth: 80 kHz

Autorange settling time: The multimeter autoranges and settles faster than its minimum (fastest) sample rate.

DC Voltage

Accuracy conditions for table below: Autozero on, one hour warmup. Temperature within ±5°C of calibration temperature (module calibrated at 18°C to 28°C).

Resolution vs. Aperture (volts)						
Range	Input Resistance	267/320 ms	16.7/20 ms	2.5 ms	100 μs	10 μs
125 mV	>100 MΩ	.03 μV	.12 μV	0.5 μV	4.0 μV	7.6 μV
1 V	>100 MΩ	.24 μV	1.0 μV	4.0 μV	30 μV	61 μV
8 V	>100 MΩ	2.0 μV	7.6 μV	30 μV	250 μV	488 μV
64 V	10 MΩ±5%	15 μV	61 μV	250 μV	2.0 mV	3.9 mV
300 V	10 MΩ±5%	122 μV	488 μV	2.0 mV	16 mV	31 mV

Accuracy conditions for table below: Autozero on, one hour warmup. Within 24 hours and ±1°C of calibration temperature (module calibrated at 18°C to 28°C).

24-Hour Accuracy vs. Aperture ± (% of reading + volts)					
Range	267/320 ms	16.7/20 ms	2.5 ms	100 μs	10 μs
125 mV	.008% + 5.0 μV	.008% + 5.0 μV	.008% + 10 μV	.05% + 30 μV	.05% + 60 μV
1 V	.008% + 10 μV	.008% + 15 μV	.008% + 15 μV	.05% + 100 μV	.05% + 200 μV
8 V	.005% + 50 μV	.005% + 50 μV	.005% + 80 μV	.05% + 750 μV	.05% + 1.5 mV
64 V	.01% + 1.0 mV	.01% + 1.0 mV	.01% + 1.0 mV	.05% + 5.0 mV	.05% + 20 mV
300 V	.01% + 5.0 mV	.01% + 5.0 mV	.01% + 5.0 mV	.05% + 30 mV	.05% + 80 mV

Accuracy conditions for table below: Autozero on,, one hour warmup. Within 90 days and ±5°C of calibration temperature (module calibrated at 18°C to 28°C).

90-Day Accuracy vs. Aperture ± (% of reading + volts)					
Range	267/320 ms	16.7/20 ms	2.5 ms	100 μs	10 μs
125 mV	.023% + 5.0 μV	.023% + 5.0 μV	.023% + 10 μV	.065% + 30 μV	.115% + 60 μV
1 V	.013% + 10 μV	.013% + 15 μV	.013% + 15 μV	.055% + 100 μV	.1% + 200 μV
8 V	.010% + 50 μV,	.01% + 50 μV	.01% + 80 μV	.055% + 750 μV	.1% + 1.5 mV
64 V	.015% + 1.0 mV	.015% + 1.0 mV	.015% + 1.0 mV	.055% + 5.0 mV	.1% + 20 mV
300 V	.015% + 5.0 mV	.015% + 5.0 mV	.015% + 5.0 mV	.055% + 30 mV	.1% + 80 mV

Accuracy conditions for table below: Autozero on, one hour warmup. Within 1 year and ±5°C of calibration termperature (module calibrated at 18°C to 28°C).

1-Year Accuracy vs. Aperture ± (% of reading + volts)					
Range	**267/320 ms**	**16.7/20 ms**	**2.5 ms**	**100 µs**	**10 µs**
125 mV	.033% + 5 µV	.033% + 5 µV	.033% + 10 µV	.075% + 30 µV	.125% + 60 µV
1V	.023% + 10 µV	.023% + 15 µV	.023% + 15 µV	.065% + 100 µV	.110% + 200 µV
8 V	.020% + 50 µV	.020% + 50 µV	.020% + 80 µV	.065% + 750 µV	.110% + 1.5 mV
64 V	.025% + 1 mV	.025% + 1 mV	.025% + 1 mV	.065% + 5 mV	.110% + 20 mV
300 V	.025% + 5 mV	.025% + 5 mV	.025% + 5 mV	.065% + 30 mV	.110% + 80 mV

Temperature Coefficient ± (% of reading)/°C		
Range	**Temperature Coeficient**	**10µs Aperture**
125 V	0.003	0.013
1 V	0.001	0.01
8 V	0.001	0.01
64 V	0.001	0.01
300 V	0.001	0.01

Conditions: 0°C to (cal temp -5°C), (cal temp +5°C) to 55°C

Autozero Off Offset Error (volts)	
Range	**Additional Offset Error**
125 V	20 µV
1 V	20 µV
8 V	20 µV
64 V	1 mV
300 V	1 mV

Conditions: Stable environment, 24 hours, ± 1°C

Four-Wire Resistance

Input Characteristics

Measurement Characteristics vs. Range							
Range	Source Current	Maximum Open Circuit Voltage	Maximum Allowable Current Source Lead Resistance	Maximum Allowable Common Lead Resistance	Maximum Allowable Offset Volts For Offset Compensated Ohms	Default Measurement Settling Time	Default Range Function Change Settling Time
256 Ω	488 μA	11.5 V	20 kΩ	150 Ω	12 mV	0	0
2 kΩ	488 μA	11.5 V	15 kΩ	150 Ω	100 mV	0	0
16 kΩ	61 μA	11.5 V	100 kΩ	2 kΩ	100 mV	0	0
131 kΩ	61 μA	11.5 V	20 kΩ	10 kΩ	0.8 V	0	2 ms
1 MΩ	7.6 μA	11.5 V	100 kΩ	100 kΩ	0.8 V	0	11 ms

Conditions: Settling times may need to be increased (programmably) if load capacitance is greater than 200 pF.

Resolution vs. Aperture (ohms)					
Range	267/320 ms	16.7/20 ms	2.5 ms	100 μs	10 μs
256 Ω	0.06 mΩ	0.25 mΩ	1 mΩ	8 mΩ	15 mΩ
2 kΩ	0.5 mΩ	2 mΩ	8 mΩ	60 mΩ	125 mΩ
16 kΩ	4 mΩ	15 mΩ	60 mΩ	500 mΩ	1 Ω
131 kΩ	30 mΩ	125 mΩ	500 mΩ	4 Ω	8 Ω
1 MΩ	0.25 mΩ	1 Ω	4 Ω	30 Ω	64 Ω

Accuracy conditions for table below: Autozero on, one-hour warmup. Within 24 hours and ±1°C of calibration temperature (module calibrated at 18°C to 28°C).

24-Hour Accuracy vs. Aperture ± (% of reading + ohms)					
Range	267/320 ms	16.7/20 ms	2.5 ms	100 μs	10 μs
256 Ω	.015% + 10 mΩ	.015% + 10 mΩ	.015% + 10 mΩ	.05% + 50 mΩ	.05% + 50 mΩ
2 kΩ	.015% + 20 mΩ	.015% + 20 mΩ	.015% + 20 mΩ	.05% + 150 mΩ	.05% + 200 mΩ
16 kΩ	.015% + 200 mΩ	.015% + 200 mΩ	.015% + 200 mΩ	.05% + 1 Ω	.05% + 2 Ω
131 kΩ	.015% + 1Ω	.015% + 1Ω	.015% + 1Ω	.05% + 8 Ω	.05% + 16 Ω
1 MΩ	.015% + 10 Ω	.015% + 10 Ω	.015% + 10 Ω	.05% + 60 Ω	.05% + 120 Ω

Accuracy condition for table below: Autozero on, one-hour warmup. Within 90 days and ±5°C of calibration temperature (module calibrated at 18°C to 28°C).

90-Day Accuracy vs. Aperture ± (% of reading + ohms)					
Range	**267/320 ms**	**16.7/20 ms**	**2.5 ms**	**100 µs**	**10 µs**
256 Ω	.035% + 10 mΩ	.035% + 10 mΩ	.035% + 10 mΩ	.07% + 50 mΩ	.12% + 50 mΩ
2 kΩ	.025% + 20 mΩ	.025% + 20 mΩ	.025% + 20 mΩ	.06% + 150 mΩ	.10% + 200 mΩ
16 kΩ	.025% + 200 mΩ	.025% + 200 mΩ	.025% + 200 mΩ	.06% + 1 Ω	.1% + 2 Ω
131 kΩ	.025% + 1Ω	.025% + 1Ω	.025% + 1Ω	.06% + 8 Ω	.1% + 16 Ω
1 MΩ	.025% + 10 Ω	.025% + 10 Ω	.025% + 10 Ω	.06% + 60 Ω	.1% + 120 Ω

Accuracy conditions for table below: Autozero on, one-hour warmup. Within 1 year and ±5°C of calibration temperature (module calibrated at 18°C to 28°C).

1-Year Accuracy vs. Aperture ± (% of reading + ohms)					
Range	**267/320 ms**	**16.7/20 ms**	**2.5 ms**	**100 µs**	**10 µs**
256 Ω	.05% + 10 mΩ	.05% + 10 mΩ	.05% + 10 mΩ	.085% + 50 mΩ	.135% + 50 mΩ
2 kΩ	.04% + 20 mΩ	.04% + 20 mΩ	.04% + 20 mΩ	.075% + 150 mΩ	.115% + 200 mΩ
16 kΩ	.04% + 200 mΩ	.04% + 200 mΩ	.04% + 200 mΩ	.075% + 1 Ω	.115% + 2 Ω
131 kΩ	.04% + 1Ω	.04% + 1Ω	.04% + 1Ω	.075% + 8 Ω	.115% + 16 Ω
1 MΩ	.04% + 10 Ω	.04% + 10 Ω	.04% + 10 Ω	.075% + 60 Ω	.115% + 120 Ω

Temperature Coefficient ± (% of reading)/°C		
Range	**Temperature Coeficient**	**10µs Aperture**
256 Ω	0.004	0.014
2 kΩ	0.002	0.01
16 kΩ	0.002	0.01
131 kΩ	0.002	0.01
1 MΩ	0.002	0.01
Conditions: 0°C to (cal temp -5°C), (cal temp +5°C) to 55°C		

Autozero Off Offset Error (ohms)	
Range	**Additional Offset Error**
256 Ω	40 mΩ
2 kΩ	40 mΩ
16 kΩ	300 mΩ
131 kΩ	300 mΩ
1 MΩ	3 Ω
Conditions: Stable environment, 24 hours, ± 1°C	

True RMS AC Voltage (AC coupled)
Crest Factor: 7 at 10% full scale; 1.5 at full scale

DC to 60 Hz common mode rejection (CMR)	
64 V and 300 V range	50 dB
All other ranges	86 dB
DC to 400 Hz common mode rejection (CMR)	
64 V and 300 V range	34 dB
All other ranges	70 dB

Conditions: CMR and Effective Common Mode Rejection (ECMR) measured with 1 kΩ in each of HIGH and LOW leads, 10% imbalance. LOW connected to COMMON at source. Measured with respect to earth ground.

Resolution vs. Aperture (volts)						
Range	**Input Impedance**	**267/320 ms**	**16.7/20 ms**	**2.5 ms**	**100 µs**	**10 µs**
87.5 mV	>100 mΩ, <100pF	0.03 µV	0.12 µV	0.5 µV	4 µV	7.6 µV
700 mV	>100 mΩ, <100pF	0.24 µV	1 µV	4 µV	30 µV	61 µV
5.6 V	>100 mΩ, <100pF	2 µV	7.6 µV	30 µV	250 µV	488 µV
44.8 V	10 MΩ ±5%, <100pF	15 µV	61 µV	250µV	2 mV	3.9 mV
300 V	10 MΩ ±5%, <100pF	122 µV	488 µV	2 mV	16 mV	31 mV

Accuracy conditions for table below: Autozero on, one-hour warmup. Within 24 hours and ±1°C of calibration temperature (module calibrated at 18°C to 28°C). Sine wave inputs >10% of full scale; DC component <10% of AC component.

24-Hour Accuracy vs. Aperture ± (% of reading + volts)			
Range	**Frequency**	**267/320 ms**	**All other apertures**
87.5 mV	20 - 50 Hz	2% + 200 µV	N/A
	50 Hz - 1 kHz	.5% + 200 µV	.5% + 200 µV
	1 - 5 kHz	.5% + 200 µV	.5% + 200 µV
	5 - 10 kHz	3% + 200 µV	3% + 200 µV
700 mV	20 - 50 Hz	2% + 1.5 mV	N/A
	50 Hz - 1 kHz	.5% + 1.5 mV	.5% + 1.5 mV
	1 - 5 kHz	.5% + 1.5 mV	.5% + 1.5 mV
	5 - 10 kHz	3% + 1.5 mV	3% + 1.5 mV
5.6 V	20 - 50 Hz	2% + 15 mV	N/A
	50 Hz - 1 kHz	.5% + 15 mV	.5% + 15 mV
	1 - 5 kHz	.5% + 15 mV	.5% + 15 mV
	5 - 10 kHz	3% + 15 mV	3% + 15 mV
44.8 V	20 - 50 Hz	2% + 100 mV	N/A
	50 Hz - 1 kHz	.5% + 100 mV	.5% + 100 mV
	1 - 5 kHz	1% + 100 mV	1% + 100 mV
	5 - 10 kHz	10% + 100 mV	10% + 100 mV
300 V	20 - 50 Hz	2% + 500 mV	N/A
	50 Hz - 1 kHz	.5% + 500 mV	.5% + 500 mV
	1 - 5 kHz	1% + 500 mV	1% + 500 mV
	5 - 10 kHz	10% + 500 mV	10% + 500 mV

Accuracy conditions for table below: Autozero on, one-hour warmup. Within 90 days and ±5°C of calibration temperature (module calibrated at 18°C to 28°C). Sine wave inputs >10% of full scale; DC component <10% of AC component.

90-Day Accuracy vs. Aperture ± (% of reading + volts)			
Range	**Frequency**	**267/320 ms**	**All other apertures**
87.5 mV	20 - 50 Hz	2.175% + 200 µV	N/A
	50 Hz - 1 kHz	.675% + 200 µV	.675% + 200 µV
	1 - 5 kHz	.675% + 200 µV	.675% + 200 µV
	5 - 10 kHz	3.175% + 200 µV	3.175% + 200 µV
700 mV	20 - 50 Hz	2.125% + 1.5 mV	N/A
	50 Hz - 1 kHz	.625% + 1.5 mV	.625% + 1.5 mV
	1 - 5 kHz	.625% + 1.5 mV	.625% + 1.5 mV
	5 - 10 kHz	3.125% + 1.5 mV	3.125% + 1.5 mV
5.6 V	20 - 50 Hz	2.125% + 15 mV	N/A
	50 Hz - 1 kHz	.625% + 15 mV	.625% + 15 mV
	1 - 5 kHz	.625% + 15 mV	.625% + 15 mV
	5 - 10 kHz	3.125% + 15 mV	3.125% + 15 mV
44.8 V	20 - 50 Hz	2.125% + 100 mV	N/A
	50 Hz - 1 kHz	.625% + 100 mV	.625% + 100 mV
	1 - 5 kHz	1.125% + 100 mV	1.125% + 100 mV
	5 - 10 kHz	10.125% + 100 mV	10.125% + 100 mV
300 V	20 - 50 Hz	2.125% + 500 mV	N/A
	50 Hz - 1 kHz	.625% + 500 mV	.625% + 500 mV
	1 - 5 kHz	1.125% + 500 mV	1.125% + 500 mV
	5 - 10 kHz	10.125% + 500 mV	10.125% + 500 mV

Accuracy conditions for table below: Autozero on, one-hour warmup. Within one year and ±5°C of calibration temperature (module calibrated at 18°C to 28°C). Sine wave inputs >10% of full scale; DC component <10% of AC component.

1-Year Accuracy vs. Aperture ± (% of reading + volts)			
Range	**Frequency**	**267/320 ms**	**All other apertures**
87.5 mV	20 - 50 Hz	2.195% + 200 µV	N/A
	50 Hz - 1 kHz	.695% + 200 µV	.695% + 200 µV
	1 - 5 kHz	.695% + 200 µV	.695% + 200 µV
	5 - 10 kHz	3.195% + 200 µV	3.195% + 200 µV
700 mV	20 - 50 Hz	2.145% + 1.5 mV	N/A
	50 Hz - 1 kHz	.645% + 1.5 mV	.645% + 1.5 mV
	1 - 5 kHz	.645% + 1.5 mV	.645% + 1.5 mV
	5 - 10 kHz	3.145% + 1.5 mV	3.145% + 1.5 mV
5.6 V	20 - 50 Hz	2.145% + 15 mV	N/A
	50 Hz - 1 kHz	.645% + 15 mV	.645% + 15 mV
	1 - 5 kHz	.645% + 15 mV	.645% + 15 mV
	5 - 10 kHz	3.145% + 15 mV	3.145% + 15 mV
44.8 V	20 - 50 Hz	2.145% + 100 mV	N/A
	50 Hz - 1 kHz	.645% + 100 mV	.645% + 100 mV
	1 - 5 kHz	1.145% + 100 mV	1.145% + 100 mV
	5 - 10 kHz	10.140% + 100 mV	10.140% + 100 mV
300 V	20 - 50 Hz	2.145% + 500 mV	N/A
	50 Hz - 1 kHz	.645% + 500 mV	.645% + 500 mV
	1 - 5 kHz	1.145% + 500 mV	1.145% + 500 mV
	5 - 10 kHz	10.140% + 500 mV	10.140% + 500 mV

Temp. Coefficient ± (% of reading)/°C		
Range	**Frequency**	**Temp. Coefficient**
87.5 mV	20 - 50 Hz	0.035
	50 Hz - 1 kHz	0.035
	1 - 5 kHz	0.035
	5 - 10 kHz	0.035
700 mV	20 - 50 Hz	0.025
	50 Hz - 1 kHz	0.025
	1 - 5 kHz	0.025
	5 - 10 kHz	0.025
5.6 V	20 - 50 Hz	0.025
	50 Hz - 1 kHz	0.025
	1 - 5 kHz	0.025
	5 - 10 kHz	0.025
44.8 V	20 - 50 Hz	0.025
	50 Hz - 1 kHz	0.025
	1 - 5 kHz	0.025
	5 - 10 kHz	0.025
300 V	20 - 50 Hz	0.025
	50 Hz - 1 kHz	0.025
	1 - 5 kHz	0.025
	5 - 10 kHz	0.025

Timer/Pacer
Timer Range: 76 µsec to 65.5 msec
Resolution: 2 µs
Accuracy: 0.01%

Programmable Delay
Delay Range: 40 µsec to 16 sec
Resolution: 2 µsec
Accuracy: 0.01%

External Trigger
Trigger Condition: negative edge
Minimum Pulse Width: 100 nsec
Maximum Trigger Rate: 5 kHz
(fixed range, 10 µsec aperture)

Typical Reading Storage

HP 75000 Mainframe	**Number of Readings**
Series B with standard memory	50,000
Series B with 512 kB memory (HP E1300/01A Opt. 010)	100,000
Series B with 1 MB memory (HP E1300/01A Opt. 011)	200,000
Series C with Command Module (HP E1406A)	100,000
Series C plus E1406A with Opt. 010	200,000

Module Size/Device Type:
B, register-based (E1326B)
C, register-based (E1411B)

Connectors Used: P1

No. Slots: 1 (standard terminal panel takes 2 slots)

VXIbus Interface Capability:
Slave, interrupter, A16, D16

Interrupt Level: 1-7, selectable

Power Requirements:

Voltage	**+5**	**+12**
Peak module current, IPM (A):	0.20	0.55
Dyanmic module current, IDM (A):	0.01	0.01

Watts/Slot: 8.5 (E1411B) 4.2 (E1326B)

Cooling/Slot:
0.14 mm H_2O @ 0.71 liter/sec (E1411B)
0.07 mm H_2O@ 0.35 liter/sec (E1326B)

Humidity: 65% 0° to 40°C

Operating Temperature: 0° to 55°C

Storage Temperature: -40° to 75°C