

# Digital Multimeters

## Tektronix DMM4050 and DMM4040 Datasheet



DMM4050

### Features & Benefits

#### Key Performance Specifications

- 6.5 Digit Resolution
- Basic VDC Accuracy of up to 0.0024% (1 yr.)
- 100 mV to 1000 V Voltage Range, with up to 100 nV Resolution
- 100  $\mu$ A to 10 A Current Range, with up to 100 pA Resolution
- 10  $\Omega$  to 1 G $\Omega$  Range, with up to 10  $\mu\Omega$  Resolution
- CAT I 1000 V, CAT II 600 V

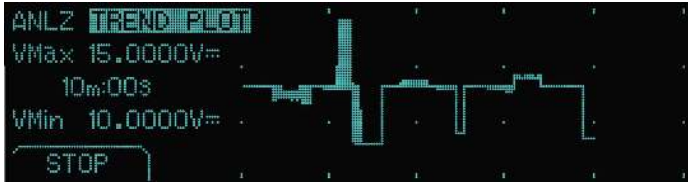
#### Available Functions and Features

- Volts, Ohms, and Amps Measurements
- True RMS (AC, AC + DC) Measurements
- Diode and Continuity Testing
- Frequency and Period Measurements
- Temperature and Capacitance Measurements (DMM4050)
- 2 $\times$ 4 Ohms 4-wire Measurement Technique
- TrendPlot™ Paperless Data Recorder Mode
- Measurement Statistics
- Histogram Mode

#### Connectivity

- Front and Rear 2 $\times$ 4 Measurement Inputs
- USB Host Port on Front Panel for Easy Storage of Measurement Data and Instrument Settings
- RS-232, LAN, and GPIB Ports on Rear Panel for Quick PC Connectivity
- Includes USB to RS-232 Interface Adapter Cable
- Includes National Instrument's LabVIEW SignalExpress™ TE Limited Edition for Connecting Your Bench

#### 3-year Warranty



TrendPlot display.

## Feature-Rich Tools for Precision Measurements

As the circuits in embedded system designs become more sophisticated with tighter tolerances, you must measure a multitude of different parameters with a high degree of accuracy to validate your design. The Tektronix DMM4050 and DMM4040 6.5 digit bench multimeters pack many different functions and analysis into one instrument, all with exceptional precision and performance.

Typical multimeter measurements – volts, ohms, and amps – are made with a basic VDC accuracy of up to 0.0024%, and resolution of 100 pA and 10  $\mu\Omega$ , ensuring you have the performance you need for today's demanding designs. You can also use the DMM4050/4040 to measure frequency and period, and to perform continuity and diode tests. For additional flexibility, the DMM4050 offers temperature and capacitance measurements. This allows you to replace your temperature meter, capacitance meter, counter, continuity tester, and traditional DMM with one versatile instrument, saving bench space and cost.

## Analyze Your Device with Graphical Display Modes

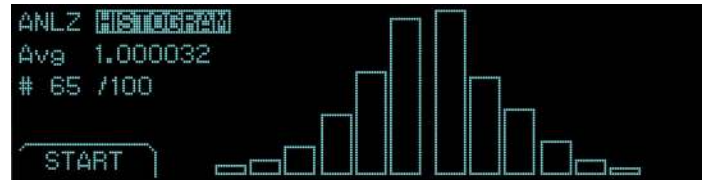
With the unique dual display of the DMM4050/4040, you can measure two different parameters of the same signal from one test connection. To reveal signal quality issues like drift, intermittent transients, and stability, you can view the data as a real-time trend plot or a histogram with the DMM4050/4040's graphical display mode, or you can use measurement statistics to track how signal parameters are changing over time.

### TrendPlot™ Paperless Recorder Mode

Depending on your test case, your signal parameters may change from instant to instant. By taking multiple measurements over minutes, hours, or days, you can quantify those changes. With TrendPlot™, you can graphically plot the trend of a measured value over time, from short time spans to extended periods of time. TrendPlot can be used with measurements like DC voltage, DC current, frequency, resistance, and temperature. AC voltage and current can be plotted as RMS measurements.



A sample of a Min/Max/Avg/SD Statistics Report.



Histogram display.

## Measurement Statistics

With integrated statistics processing, you can calculate both the average and standard deviation of a measurement, as well as track the minimum and maximum measured values, with the push of a button. Statistics can be performed on DC voltage, AC voltage, AC voltage in dB, DC current, AC current, resistance, capacitance, frequency, period, and temperature measurements.

## Histogram Plots

To graphically see the average and standard deviation of a set of measurements, you can use the histogram function to see the distribution of measurement results.

## Designed to Make Your Work Easier

The DMM4050/4040 multimeter is designed with the ease of use and familiar operation you expect from Tektronix.

## Intuitive Operation

Dedicated front-panel buttons provide fast access to frequently used functions and parameters, reducing setup time. You no longer need to search through software menus to find the function you need.

## Dual Display

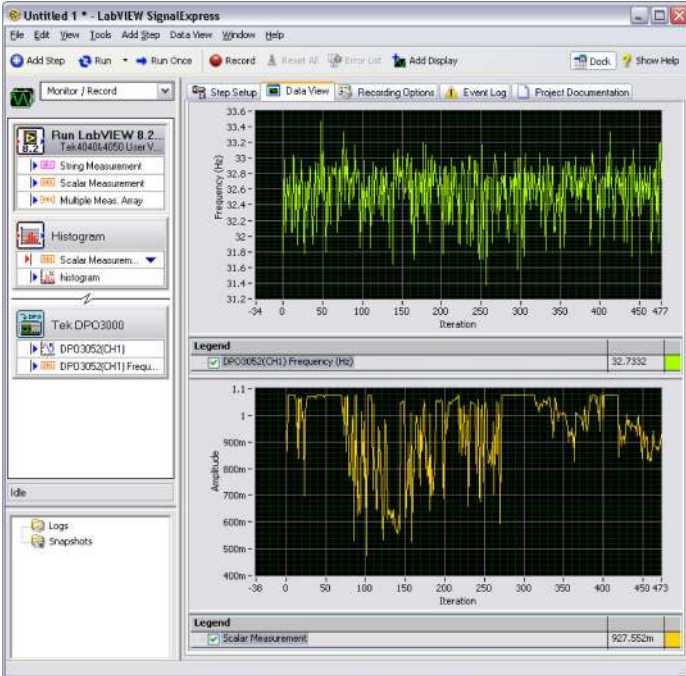
With the unique dual display, you can measure two different parameters of the same signal from one test connection.

## Easy Data Storage and PC Connectivity

A USB port on the front panel makes it easy to store measurement data and instrument setups to a memory stick. Or connect to your PC with the LAN, RS-232, or GPIB port on the back panel. A USB to RS-232 interface adapter cable is included standard with the DMM4050/4040 to make it easy to connect to your PC's USB port.

## Simple and Accurate 4-wire Measurements

Patented split terminal jacks for the 2x4 ohms function allow you to perform 4-wire measurements using only two leads instead of four. Special test lead accessories are available to enable you to establish the connection. You get excellent resolution and accuracy plus the convenience and ease of using a single pair of leads.

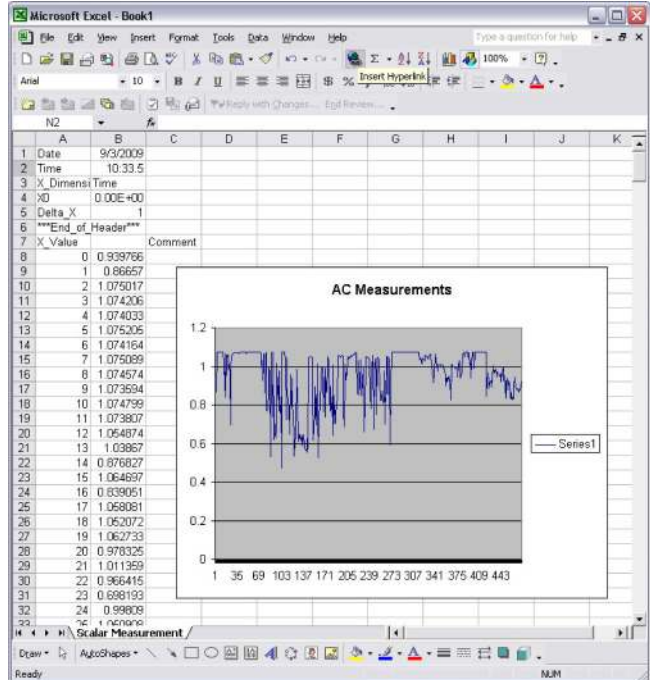


SignalExpress acquiring data from Tektronix DMM4050 and DPO3052.

### Connect Your Bench for Intelligent Debug

Easily capture, save, and analyze measurement results from your multimeter with the special Tektronix Edition of National Instrument's LabVIEW SignalExpress™ software. Every DMM4050 and DMM4040 ships with a free copy of the Limited Edition version of SignalExpress for basic instrument control, data logging, and analysis. The optional Professional Edition offers over 200 built-in functions that provide additional signal processing, advanced analysis, sweeping, limit testing, and user-defined step capabilities.

SignalExpress supports the range of Tektronix bench instruments\*1, enabling you to connect your entire test bench. You can then access the feature-rich tools packed into each instrument from one intuitive software



SignalExpress used to export DMM4050 data into Excel.

interface. This allows you to automate complex measurements requiring multiple instruments, log data for an extended period of time, time correlate data from multiple instruments, and easily capture and analyze your results, all from your PC. Only Tektronix offers a connected test bench of intelligent instruments to simplify and speed debug of your complex design.

### Performance You Can Count On

In addition to industry-leading service and support, every DMM4050 and DMM4040 multimeter comes backed with a three-year standard warranty.

\*1 NI LabVIEW SignalExpress supports the following Tektronix instruments: MSO/DPO4000/3000/2000 Series oscilloscopes, TDS3000C/2000B/1000B Series oscilloscopes, AFG3000 Series arbitrary/function generators, DMM4050/4040/4020 Series digital multimeters.

## Characteristics

### General Specifications

#### Voltage

Characteristic	Description
100 V Setting	90 V to 110 V
120 V Setting	108 V to 132 V
220 V Setting	198 V to 242 V
240 V Setting	216 V to 264 V
Frequency	47 Hz to 440 Hz. Automatically sensed at power-on
Power Consumption	28 VA peak (12 Watt average)

#### Dimensions

Dimension	mm	in.
Height	88	3.46
Width	217	8.56
Depth	297	11.7
Weight	kg	lb.
Net	3.6	8.0
Shipping	5.0	11.0

#### Display

Vacuum Fluorescent Display, dot matrix

### Environment

Characteristic	Description
Temperature	
Operating	0 °C to 55 °C
Storage	-40 °C to 70 °C
Warm Up	1 hour to full uncertainty specifications
Relative Humidity (noncondensing)	
Operating	<90% (0 °C to 28 °C) <80% (28 °C to 40 °C) <50% (40 °C to 55 °C)
Storage	<95% (-40 °C to 70 °C)
Altitude	
Operating	2,000 meters
Storage	12,000 meters
Vibration	Complies with Mil-T-28800F Type III, Class 5 (Sine only)
Safety	Designed to comply with IEC 61010-1:2000-1, UL 61010-1A1, CAN/CSA-C22.2 No. 61010.1, CAT I 1000V / CAT II 600 V
EMC	Designed to comply with IEC 61326-1:2000-11 (EMC) when used with shielded communications cables. This meter has shown susceptibility to radiated frequencies greater than 1 V/m from 250 to 450 MHz

### Triggering

Characteristic	Description
Samples per Trigger	1 to 50,000
Trigger Delay	0 s to 3600 s; in 10 µs increments
External Trigger Delay	<1 ms
External Trigger Jitter	<500 µs
Trigger Input	TTL Levels
Trigger Output	5 V max (open collector)

### Memory

Model	Description
DMM4050/4040	10,000 measurements, internal, and up to 2 Gigabyte capacity with USB memory module (available separately) through front-panel USB port

### Math Functions

Zero, dBm, dB, MX+B, Offset, DCV ratio and TrendPlot, Histogram, Statistics (min/max/average/standard deviation), and Limit Test

### Dual Function Compatibility Matrix

Primary Function	Secondary Function								
	VDC	VAC	IDC	IAC	FREQ	OHMS	DIODE	Period	RTD
VDC		X							
VAC	X				X				
IDC				X					
IAC			X		X				
FREQ								X	
OHMS									X
DIODE									
Continuity					X				

**Electrical**

Characteristic	Description
Input Protection	1000 V all ranges
Overrange	20% on all ranges except 1000 VDC, 1000 VAC, Diode, and 10 A ranges

**Remote Interfaces**

RS-232C, DTE 9-pin, 1200 to 230400 baud (RS-232C to USB cable available to connect the meter to a PC USB port) IEEE 488.2. LAN and "Ethernet 10/100BASE-T with DHCP (for IP address) option".

**Warranty**

Three years

**Electrical Specifications**

**DC Voltage Specifications**

Accuracy specifications are valid for 6½ digit resolution mode after at least a 1 hour warm-up with Auto Zero enabled.

24-hour specifications are relative to calibration standards and assume a controlled electromagnetic environment per EN 61326-1:2000-11.

Characteristic	Description
Maximum Input	1000 V on any range
Common Mode Rejection	140 dB at 50 or 60 Hz ±0.1% (1 kΩ unbalance)
Normal Mode Rejection	60 dB for NPLC of 1 or greater with analog filter off and power line frequency ±0.1% 100 dB for NPLC of 1 or greater with analog filter on and power line frequency ±0.1%
Measurement Method	Multiramp A/D
A/D Linearity	0.0002% of measurement + 0.0001% of range
Input Bias Current	<30 pA at 25 °C
Auto-zero Off Operation	Following instrument warm-up at calibration temperature ±1 °C and less than 10 minutes, add error: 0.0002% range additional error +5 µV
Analog Filter	When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting
DC Ratio	Accuracy is ±(Input accuracy + Reference accuracy), where Input accuracy = DC Voltage accuracy for the HI to LO Input (in ppm of the Input voltage), and Reference accuracy = DC Voltage accuracy for the HI to LO (Sense) Reference (in ppm of the Reference voltage)
Settling Considerations	Measurement settling times are affected by source impedance, cable dielectric characteristics, and input signal changes

**Input Characteristics**

Range	Resolution	Resolution			Input Impedance
		4½ Digits	5½ Digits	6½ Digits	
100 mV	100.0000 mV	10 µV	1 µV	100 nV	10 MΩ or >10 GΩ <sup>2</sup>
1 V	1.000000 V	100 µV	10 µV	1 µV	10 MΩ or >10 GΩ <sup>2</sup>
10 V	10.00000 V	1 mV	100 µV	10 µV	10 MΩ or >10 GΩ <sup>2</sup>
100 V	100.0000 V	10 mV	1 mV	100 µV	10 MΩ ±1%
1000 V	1,000.000 V	100 mV	10 mV	1 mV	10 MΩ ±1%

<sup>2</sup> Inputs beyond ±14 V are clamped through 200 kΩ typical. 10 MΩ is default input impedance.

### DMM4050 Accuracy

Accuracy is given as  $\pm$ (% measurement + % of range)

Range	24 Hour (23 °C $\pm$ 1 °C)	90 Days (23 °C $\pm$ 5 °C)	1 Year (23 °C $\pm$ 5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
100 mV	0.0025 + 0.003	0.0025 + 0.0035	0.0037 + 0.0035	0.0005 + 0.0005
1 V	0.0018 + 0.0006	0.0018 + 0.0007	0.0025 + 0.0007	0.0005 + 0.0001
10 V	0.0013 + 0.0004	0.0018 + 0.0005	0.0024 + 0.0005	0.0005 + 0.0001
100 V	0.0018 + 0.0006	0.0027 + 0.0006	0.0038 + 0.0006	0.0005 + 0.0001
1000 V	0.0018 + 0.0006	0.0031 + 0.001	0.0041 + 0.001	0.0005 + 0.0001

### DMM4040 Accuracy

Accuracy is given as  $\pm$ (% measurement + % of range)

Range	24 Hour (23 °C $\pm$ 1 °C)	90 Days (23 °C $\pm$ 5 °C)	1 Year (23 °C $\pm$ 5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
100 mV	0.003 + 0.003	0.004 + 0.0035	0.005 + 0.0035	0.0005 + 0.0005
1 V	0.002 + 0.0006	0.003 + 0.0007	0.004 + 0.0007	0.0005 + 0.0001
10 V	0.0015 + 0.0004	0.002 + 0.0005	0.0035 + 0.0005	0.0005 + 0.0001
100 V	0.002 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0005 + 0.0001
1000 V	0.002 + 0.0006	0.0035 + 0.0010	0.0045 + 0.0010	0.0005 + 0.0001

### Additional Errors

Digits	NPLC	Additional NPLC Noise Error
6½	100	0% of range
6½	10	0% of range
5½	1	0.001% of range
5½	0.2	0.0025% of range $\pm$ 12 $\mu$ V
4½	0.02	0.017% of range $\pm$ 17 $\mu$ V

### AC Voltage Specifications

AC Voltage specifications are for AC sinewave signals >5% of range. For inputs from 1% to 5% of range and <50 kHz, add an additional error of 0.1% of range, and for 50 kHz to 100 kHz, add 0.13% of range.

Characteristic	Description
Maximum Input	1000 V <sub>RMS</sub> or 1414 V peak or $8 \times 10^7$ Volts-Hertz product (whichever is less) for any range
Measurement Method	AC-coupled true RMS. Measures the AC component of input with up to 1000 VDC bias on any range
AC Filter Bandwidth	
Slow	3 Hz - 300 kHz
Medium	20 Hz - 300 kHz
Fast	200 Hz - 300 kHz
Common Mode Rejection	70 dB at 50 Hz or 60 Hz $\pm$ 0.1% (1 k $\Omega$ unbalance)
Maximum Crest Factor	5:1 at Full Scale
Additional Crest Factor Errors (<100 Hz)	Crest factor 1-2, 0.05% of full scale Crest factor 2-3, 0.2% of full scale Crest factor 3-4, 0.4% of full scale Crest factor 4-5, 0.5% of full scale <b>Only applies for non-sinusoid signals</b>

### Input Characteristics

Range	Resolution	Resolution			Input Impedance
		4½ Digits	5½ Digits	6½ Digits	
100 mV	100.0000 mV	10 $\mu$ V	1 $\mu$ V	100 nV	1 M $\Omega$ $\pm$ 2% shunted by <100 pf
1 V	1.000000 V	100 $\mu$ V	10 $\mu$ V	1 $\mu$ V	
10 V	10.00000 V	1 mV	100 $\mu$ V	10 $\mu$ V	
100 V	100.0000 V	10 mV	1 mV	100 $\mu$ V	
1000 V	1,000.000 V	100 mV	10 mV	1 mV	

**DMM4050/4040 Accuracy**

Accuracy is given as  $\pm$ (% measurement + % of range)

Range	Frequency	AC Filter			Temperature Coefficient/°C Outside 18 to 28 °C
		24 Hour (23 °C $\pm$ 1 °C)	90 Days (23 °C $\pm$ 5 °C)	1 Year (23 °C $\pm$ 5 °C)	
100 mV	3 - 5 Hz	1.0 + 0.03	1.0 + 0.04	1.0 + 0.04	0.1 + 0.004
	5 - 10 Hz	0.35 + 0.03	0.35 + 0.04	0.35 + 0.04	0.035 + 0.004
	10 Hz - 20 kHz	0.04 + 0.03	0.05 + 0.04	0.06 + 0.04	0.005 + 0.004
	20 - 50 kHz	0.1 + 0.05	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 - 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 - 300 kHz <sup>3</sup>	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.20 + 0.02
1 V	3 - 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 - 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz - 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 - 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 - 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 - 300 kHz <sup>3</sup>	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
10 V	3 - 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 - 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz - 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 - 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 - 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 - 300 kHz <sup>3</sup>	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
100 V	3 - 5 Hz	1.0 + 0.02	1.0 + 0.03	1.0 + 0.03	0.1 + 0.003
	5 - 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
	10 Hz - 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.005 + 0.003
	20 - 50 kHz	0.1 + 0.04	0.11 + 0.05	0.12 + 0.05	0.011 + 0.005
	50 - 100 kHz	0.55 + 0.08	0.6 + 0.08	0.6 + 0.08	0.06 + 0.008
	100 - 300 kHz <sup>3</sup>	4.0 + 0.50	4.0 + 0.50	4.0 + 0.50	0.2 + 0.02
1000 V	3 - 5 Hz	1.0 + 0.015	1.0 + 0.0225	1.0 + 0.0225	0.1 + 0.00225
	5 - 10 Hz	0.35 + 0.015	0.35 + 0.0225	0.35 + 0.0225	0.035 + 0.00225
	10 Hz - 20 kHz	0.04 + 0.015	0.05 + 0.0225	0.06 + 0.0225	0.005 + 0.00225
	20 - 50 kHz	0.1 + 0.03	0.11 + 0.0375	0.12 + 0.0375	0.011 + 0.00375
	50 - 100 kHz <sup>4</sup>	0.55 + 0.06	0.6 + 0.06	0.6 + 0.06	0.06 + 0.006
	100 - 300 kHz <sup>3, 4</sup>	4.0 + 0.375	4.0 + 0.375	4.0 + 0.375	0.2 + 0.015

<sup>3</sup> Typically 30% reading error at 1 MHz.

<sup>4</sup> 1000 V range is limited to  $8 \times 10^7$  Volt-Hertz.

**Additional Low Frequency Errors**

Error is stated as % of reading.

Frequency	AC Filter		
	3 Hz (Slow)	20 Hz (Medium)	200 Hz (Fast)
10 - 20 Hz	0	0.25	—
20 - 40 Hz	0	0.02	—
40 - 100 Hz	0	0.01	0.55
100 - 200 Hz	0	0	0.2
200 Hz - 1 kHz	0	0	0.02
>1 kHz	0	0	0

## Resistance

Specifications are for 4-wire resistance function, 2 × 4-wire resistance, or 2-wire resistance with zero. If zero is not used, add 0.2 Ω for 2-wire resistance plus lead resistance, and add 20 mΩ for 2 × 4-wire resistance function.

Characteristic	Description
Measurement Method	Current source referenced to LO input
Max Lead Resistance (4-wire ohms)	10% of range per lead for 10 Ω, 100 Ω, 1 kΩ ranges. 1 kΩ per lead on all other ranges
Input Protection	1000 V on all ranges
Common Mode Rejection	140 dB at 50 or 60 Hz ±0.1% (1 kΩ unbalance)
Normal Mode Rejection	60 dB for NPLC of 1 or greater with analog filter off and power line frequency ±0.1% 100 dB for NPLC of 1 or greater with analog filter on and power line frequency ±0.1%
Analog Filter	When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting

## Input Characteristics

Range	Resolution	Resolution			Source Current
		4½ Digits	5½ Digits	6½ Digits	
10 Ω	10.00000 Ω	1 mΩ	100 μΩ	10 μΩ	5 mA / 13 V
100 Ω	100.0000 Ω	10 mΩ	1 mΩ	100 μΩ	1 mA / 6 V
1 kΩ	1.000000 kΩ	100 mΩ	10 mΩ	1 mΩ	1 mA / 6 V
10 kΩ	10.00000 kΩ	1 Ω	100 mΩ	10 mΩ	100 μA / 6 V
100 kΩ	100.0000 kΩ	10 Ω	1 Ω	100 mΩ	10 μA / 13 V
1 MΩ	1.000000 MΩ	100 Ω	10 Ω	1 Ω	10 μA / 13 V
10 MΩ	10.00000 MΩ	1 kΩ	100 Ω	10 Ω	1 μA / 13 V
100 MΩ	100.0000 MΩ	10 kΩ	1 kΩ	100 Ω	1 μA    10 MΩ / 10 V
1.0 GΩ	1.000000 GΩ	100 kΩ	10 kΩ	1 kΩ	1 μA    10 MΩ / 10 V

## DMM4050/4040 Accuracy

Accuracy is given as ±(% measurement + % of range)

Range	24 Hour (23 °C ±1 °C)	90 Days (23 °C ±5 °C)	1 Year (23 °C ±5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
10 Ω	0.003 + 0.01	0.008 + 0.03	0.01 + 0.03	0.0006 + 0.0005
100 Ω	0.003 + 0.003	0.008 + 0.004	0.01 + 0.004	0.0006 + 0.0005
1 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
10 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
100 kΩ	0.002 + 0.0005	0.008 + 0.001	0.01 + 0.001	0.0006 + 0.0001
1 MΩ	0.002 + 0.001	0.008 + 0.001	0.01 + 0.001	0.001 + 0.0002
10 MΩ	0.015 + 0.001	0.02 + 0.001	0.04 + 0.001	0.003 + 0.0004
100 MΩ	0.3 + 0.01	0.8 + 0.01	0.8 + 0.01	0.15 + 0.0002
1 GΩ	1.0 + 0.01	1.5 + 0.01	2.0 + 0.01	0.6 + 0.0002

## Additional Ohms Errors

Digits	NPLC	Additional NPLC Noise Error
6½	100	0% of range
6½	10	0% of range
5½	1	0.001% of range
5½	0.2	0.003% of range ±7 mΩ
4½	0.02	0.017% of range ±15 mΩ

## DC Current

Characteristic	Description
Input Protection	Tool-accessible 11 A / 1000 V and 440 mA / 1000 V fuses, limits of 400 mA continuous 550 mA for 2 minutes on, 1 minute off
Common Mode Rejection	140 dB at 50 or 60 Hz $\pm 0.1\%$ (1 k $\Omega$ unbalance)
Normal Mode Rejection	60 dB for NPLC of 1 or greater with analog filter off and power line frequency $\pm 0.1\%$ 100 dB for NPLC of 1 or greater with analog filter on and power line frequency $\pm 0.1\%$
Analog Filter	When using the analog filter, specifications are relative to within one hour of using the ZERO function for that range and NPLC setting

## Input Characteristics

Range	Resolution	Resolution			Shunt Resistance (Ohms)	Burden Voltage
		4½ Digits	5½ Digits	6½ Digits		
100 $\mu$ A	100.0000 $\mu$ A	10 nA	1 nA	100 pA	100 $\Omega$	<0.015 V
1 mA	1.000000 mA	100 nA	10 nA	1 nA	100 $\Omega$	<0.15 V
10 mA	10.00000 mA	1 $\mu$ A	100 nA	10 nA	1 $\Omega$	<0.025 V
100 mA	100.0000 mA	10 $\mu$ A	1 $\mu$ A	100 nA	1 $\Omega$	<0.25 V
400 mA <sup>7</sup>	400.000 mA	100 $\mu$ A	10 $\mu$ A	1 $\mu$ A	1 $\Omega$	<0.50 V
1 A <sup>6</sup>	1.000000 A	100 $\mu$ A	10 $\mu$ A	1 $\mu$ A	0.01 $\Omega$	<0.05 V
3 A <sup>5</sup>	3.00000 A	1 mA	100 $\mu$ A	10 $\mu$ A	0.01 $\Omega$	<0.15 V
10 A	10.00000 A	1 mA	100 $\mu$ A	10 $\mu$ A	0.01 $\Omega$	<0.5 V

<sup>5</sup> Part of 10 A range.

<sup>6</sup> Available on the front-panel terminal only.

<sup>7</sup> 400 mA continuously; 550 mA for 2 minutes on, 1 minute off.

## DMM4050/4040 Accuracy

Accuracy is given as  $\pm$ (% measurement + % of range)

Range	24 Hour (23 °C $\pm 1$ °C)	90 Days (23 °C $\pm 5$ °C)	1 Year (23 °C $\pm 5$ °C)	Temperature Coefficient/°C Outside 18 to 28 °C
100 $\mu$ A	0.01 + 0.02	0.04 + 0.025	0.05 + 0.025	0.002 + 0.003
1 mA	0.007 + 0.005	0.030 + 0.005	0.05 + 0.005	0.002 + 0.0005
10 mA	0.007 + 0.02	0.03 + 0.02	0.05 + 0.02	0.002 + 0.002
100 mA	0.01 + 0.004	0.03 + 0.005	0.05 + 0.005	0.002 + 0.0005
400 mA <sup>7</sup>	0.03 + 0.004	0.04 + 0.005	0.05 + 0.005	0.005 + 0.0005
1 A <sup>6</sup>	0.03 + 0.02	0.04 + 0.02	0.05 + 0.02	0.005 + 0.001
3 A <sup>5,6</sup>	0.05 + 0.02	0.08 + 0.02	0.1 + 0.02	0.005 + 0.002
10 A <sup>6</sup>	0.1 + 0.008	0.12 + 0.008	0.15 + 0.008	0.005 + 0.0008

<sup>5</sup> Part of 10 A range.

<sup>6</sup> Available on the front-panel terminal only.

<sup>7</sup> 400 mA continuously; 550 mA for 2 minutes on, 1 minute off.

## Additional Current Errors

Digits	NPLC	Additional NPLC Noise Error for 1 mA, 100 mA, 400 mA, 3 A, and 10 A	Additional NPLC Noise Error for 100 $\mu$ A, 10 mA, 1 A
6½	100	0% of range	0% of range
6½	10	0% of range	0% of range
5½	1	0.001% of range	0.01% of range
5½	0.2	0.11% of range $\pm 4$ $\mu$ A	0.11% of range $\pm 4$ $\mu$ A
4½	0.02	0.04% of range $\pm 4$ $\mu$ A	0.28% of range $\pm 4$ $\mu$ A

## AC Current

The following AC current specifications are for sinusoidal signals with amplitudes greater than 5% of range. For inputs from 1% to 5% of range, add an additional error of 0.1% of range.

Characteristic	Description
Input Protection	Tool-accessible 11 A / 1000 V and 440 mA / 1000 V fuses, limits of 400 mA continuous 550 mA for 2 minutes on, 1 minute off
Measurement Method	AC-coupled true RMS, DC-coupled to the fuse and shunt (no blocking capacitor)
AC Filter Bandwidth	
Slow	3 Hz to 10 kHz
Medium	20 Hz to 10 kHz
Fast	200 Hz to 10 kHz
Maximum Crest Factor	5:1 at Full Scale
Additional Crest Factor Errors (<100 Hz)	Crest factor 1-2, 0.05% of full scale Crest factor 2-3, 0.2% of full scale Crest factor 3-4, 0.4% of full scale Crest factor 4-5, 0.5% of full scale <b>Only applies to non-sinusoid signals</b>

## Input Characteristics

Range	Resolution	Resolution			Shunt Resistance (Ohms)	Burden Voltage
		4½ Digits	5½ Digits	6½ Digits		
100 µA	100.0000 µA	10 nA	1 nA	100 pA	100 Ω	<0.015 V
1 mA	1.000000 mA	100 nA	10 nA	1 nA	100 Ω	<0.15 V
10 mA	10.00000 mA	1 µA	100 nA	10 nA	1 Ω	<0.025 V
100 mA	100.0000 mA	10 µA	1 µA	100 nA	1 Ω	<0.25 V
400 mA <sup>9</sup>	400.000 mA	100 µA	10 µA	1 µA	1 Ω	<0.50 V
1 A <sup>8</sup>	1.000000 A	100 µA	10 µA	1 µA	0.01 Ω	<0.05 V
3 A <sup>5,8</sup>	3.00000 A	1 mA	100 µA	10 µA	0.01 Ω	<0.05 V
10 A <sup>8</sup>	10.00000 A	1 mA	100 µA	10 µA	0.01 Ω	<0.5 V

<sup>5</sup> Part of 10 A range.

<sup>8</sup> Available at front-panel connectors only.

<sup>9</sup> 400 mA continuously; 550 mA for 2 minutes on, 1 minute off; maximum crest factor 3:1 at 400 mA.

**DMM4050/4040 Accuracy**

Accuracy is given as  $\pm$ (% measurement + % of range)

Range	Frequency	24 Hour (23 °C $\pm$ 1 °C)	90 Days (23 °C $\pm$ 5 °C)	1 Year (23 °C $\pm$ 5 °C)	Temperature
					Coefficient/°C Outside 18 to 28 °C
100 $\mu$ A	3 - 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.2 + 0.006
	5 - 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.1 + 0.006
	10 Hz - 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 - 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
1 mA	3 - 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 - 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz - 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 - 10 kHz	0.2 + 0.25	0.2 + 0.25	0.2 + 0.25	0.03 + 0.006
10 mA	3 - 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.2 + 0.006
	5 - 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.1 + 0.006
	10 Hz - 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 - 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
100 mA	3 - 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 - 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz - 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 - 10 kHz	0.2 + 0.25	0.2 + 0.25	0.2 + 0.25	0.03 + 0.006
400 mA <sup>7</sup>	3 - 5 Hz	1.0 + 0.1	1.0 + 0.1	1.0 + 0.1	0.1 + 0.006
	5 - 10 Hz	0.3 + 0.1	0.3 + 0.1	0.3 + 0.1	0.035 + 0.006
	10 Hz - 5 kHz	0.1 + 0.1	0.1 + 0.1	0.1 + 0.1	0.015 + 0.006
	5 - 10 kHz	0.2 + 0.7	0.2 + 0.7	0.2 + 0.7	0.03 + 0.006
1 A <sup>6</sup>	3 - 5 Hz	1.0 + 0.04	1.0 + 0.04	1.0 + 0.04	0.1 + 0.006
	5 - 10 Hz	0.3 + 0.04	0.3 + 0.04	0.3 + 0.04	0.035 + 0.006
	10 Hz - 5 kHz	0.1 + 0.04	0.1 + 0.04	0.1 + 0.04	0.015 + 0.006
	5 - 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
3 A <sup>5,6</sup>	3 - 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.1 + 0.006
	5 - 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.035 + 0.006
	10 Hz - 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 - 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006
10 A <sup>6</sup>	3 - 5 Hz	1.1 + 0.06	1.1 + 0.06	1.1 + 0.06	0.1 + 0.006
	5 - 10 Hz	0.35 + 0.06	0.35 + 0.06	0.35 + 0.06	0.035 + 0.006
	10 Hz - 5 kHz	0.15 + 0.06	0.15 + 0.06	0.15 + 0.06	0.015 + 0.006
	5 - 10 kHz	0.35 + 0.7	0.35 + 0.7	0.35 + 0.7	0.03 + 0.006

<sup>5</sup> Part of 10 A range.

<sup>6</sup> Available on the front-panel terminal only.

<sup>7</sup> 400 mA continuously; 550 mA for 2 minutes on, 1 minute off.

**Additional Low-frequency Errors**

Error is stated as % of reading.

Frequency	AC Filter		
	3 Hz (Slow)	20 Hz (Medium)	200 Hz (Fast)
10 - 20 Hz	0	0.25	—
20 - 40 Hz	0	0.02	—
40 - 100 Hz	0	0.01	0.55
100 - 200 Hz	0	0	0.2
200 Hz - 1 kHz	0	0	0.02
>1 kHz	0	0	0

## Frequency

Characteristic	Description
Gate Time	Programmable to 1 s, 100 ms, and 10 ms
Measurement Method	Flexible counting technique. AC-coupled input using the AC voltage measurement function
Settling Considerations	When measuring frequency or period after a DC offset voltage change, errors may occur. For the most accurate measurement, wait up to 1 second for the input blocking capacitor to settle
Measurement Considerations	To minimize measurement errors, shield inputs from external noise when measuring low-voltage, low-frequency signals

### DMM4050/4040 Accuracy

Accuracy is given as ± % measurement

Range	Frequency	24 Hour (23 °C ±1 °C)	90 Days (23 °C ±5 °C)	1 Year (23 °C ±5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
100 mV to 1000 V <sup>10, 11</sup>	3 - 5 Hz	0.1	0.1	0.1	0.005
	5 - 10 Hz	0.05	0.05	0.05	0.005
	10 - 40 Hz	0.03	0.03	0.03	0.001
	40 Hz - 300 kHz	0.006	0.01	0.01	0.001
	300 kHz - 1 MHz	0.006	0.01	0.01	0.001

<sup>10</sup> Limited to 8 × 10<sup>7</sup> Volt-Hertz

<sup>11</sup> Input >100 mV. For 10 - 100 mV, multiply percent measurement error by 10.

### Gate Time vs. Resolution

Gate Time	Resolution
0.01	5½
0.1	6½
1.0	6½

### Additional Low-frequency Errors

Error stated as percent of measurement for inputs >100 mV. For 10 - 100 mV, multiply percent by 10.

Frequency	NPLC		
	6½	5½	4½
3 - 5 Hz	0	0.12	0.12
5 - 10 Hz	0	0.17	0.17
10 - 40 Hz	0	0.2	0.2
40 - 100 Hz	0	0.06	0.21
100 - 300 Hz	0	0.03	0.21
300 Hz - 1 kHz	0	0.01	0.07
>1 kHz	0	0	0.02

### Capacitance (DMM4050 Only)

Accuracy is stated as  $\pm$ (% of measurement + % of range)

Range	Resolution	1 Year Accuracy <sup>12</sup> (23 °C $\pm$ 5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
1 nF	1 pF	2% $\pm$ 2.5%	0.05 + 0.05
10 nF	10 pF	1% $\pm$ 0.5%	0.05 + 0.01
100 nF	100 pF	1% $\pm$ 0.5%	0.01 + 0.01
1 $\mu$ F	1 nF	1% $\pm$ 0.5%	0.01 + 0.01
10 $\mu$ F	10 nF	1% $\pm$ 0.5%	0.01 + 0.01
100 $\mu$ F	100 nF	1% $\pm$ 0.5%	0.01 + 0.01
1 mF	1 $\mu$ F	1% $\pm$ 0.5%	0.01 + 0.01
10 mF	10 $\mu$ F	1% $\pm$ 0.5%	0.01 + 0.01
100 mF	100 $\mu$ F	4% $\pm$ 0.2%	0.05 + 0.05

<sup>12</sup> Stated accuracy is attained when Zero function is used.

### Temperature (DMM4050 only)

Test Current: 1 mA

Accuracy is stated as  $\pm$  °C and is based on a Platinum RT100 (DIN IEC 751, 385 type) RTD with less than 10  $\Omega$  lead resistance. The accuracy listed in the table below are valid only when using the 4-wire RTD measurement function. Specifications do not include probe accuracy, which must be added.

Range	Resolution	Accuracy		Temperature Coefficient/°C Outside 18 to 28 °C
		90 Days (23 °C $\pm$ 5 °C)	1 Year (23 °C $\pm$ 5 °C)	
-200 °C	0.001 °C	0.06	0.09	0.0025
-100 °C	0.001 °C	0.05	0.08	0.002
0 °C	0.001 °C	0.04	0.06	0.002
100 °C	0.001 °C	0.05	0.08	0.002
300 °C	0.001 °C	0.1	0.12	0.002
600 °C	0.001 °C	0.18	0.22	0.002

### Additional Errors

Digits	NPLC	Additional NPLC Noise Error
6½	100	0 °C
6½	10	0 °C
5½	1	0.03 °C
5½	0.2	0.12 °C
4½	0.02	0.6 °C

### Continuity

Characteristic	Description
Continuity Threshold	Selectable between 1 Ω and 1000 Ω
Test Current	1 mA
Response Time	300 S/s with audible tone

Accuracy is given as ±(% measurements + % of range)

Range	24 Hour (23 °C ±1 °C)	90 Days (23 °C ±5 °C)	1 Year (23 °C ±5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
1000.0 Ω	0.002 + 0.01	0.008 + 0.02	0.01 + 0.02	0.001 + 0.002

### Measurement Rates (IEEE488<sup>16</sup>)

Function	Digits	Setting	Integration Time 60 Hz (50 Hz)	Measurements/Second <sup>13</sup>	
				DMM4040	DMM4050
DC Volts, DC Current, and Resistance	6½	100 NPLC	1.67 (2) s	0.6 (0.5)	0.6 (0.5)
	6½	10 NPLC	167 (200) ms	6 (5)	6 (5)
	5½	1 NPLC	16.7 (20) ms	60 (50)	60 (50)
	5½	0.2 NPLC	3.3 ms	270	270
	4½	0.02 NPLC	500 μs	995	995
AC Voltage and AC Current <sup>14</sup>	6½	3 Hz		0.47	0.47
	6½	20 Hz		1.64	1.64
	6½	200 Hz <sup>15</sup>		4.5	4.5
Frequency and Period	6½	1 s		1	1
	5½	100 ms		9.8	9.8
	4½	10 ms		80	80
Capacitance	6½			NA	2

<sup>13</sup> Typical measurement rates with auto-zero off, delay = 0, display off, auto range off and math off.

<sup>14</sup> Maximum measurement rates for 0.01% of AC step. When DC input varies, additional settling delay is required.

<sup>15</sup> For remote operation or external trigger using default settling delay.

<sup>16</sup> Note that the measurement rates for RS232 can vary depending on the baud rate chosen. If the baud rate selected is 115,200, the maximum measurement rate is 711 measurements. The LAN bus has a maximum measurement rate of 963 measurements.

### Diode Test

Characteristic	Description
Test Current	100 μA or 1 mA
Response Time	300 S/s with audible tone

Accuracy is given as ±(% measurements + % of range)

Range	24 Hour (23 °C ±1 °C)	90 Days (23 °C ±5 °C)	1 Year (23 °C ±5 °C)	Temperature Coefficient/°C Outside 18 to 28 °C
5.0000 V	0.002 + 0.002	0.008 + 0.002	0.01 + 0.002	0.001 + 0.002
10.0000 V	0.002 + 0.001	0.008 + 0.002	0.01 + 0.002	0.001 + 0.002

## Ordering Information

### Models

Model	Description
DMM4040	6.5 Digit Multimeter
DMM4050	6.5 Digit Multimeter

**DMM4050/4040 Includes:** Meter, TL710 Test Leads, Line Cord, Calibration Certificate, Calibration Data Report, Safety and Installation Instructions including Warranty Statement, CD-ROM with User Manual (English, French, Italian, German, Spanish, Simplified Chinese, Traditional Chinese, Korean, Russian, Japanese) and Connectivity Information, RS-232 to USB Adapter Cable, National Instruments LabVIEW SignalExpress™ Tektronix Edition Limited Edition Software.

Please specify power plug when ordering.

### Instrument Options

#### Power Plug Options

Option	Description
Opt. A0	North America
Opt. A1	Universal Euro
Opt. A2	United Kingdom
Opt. A3	Australia
Opt. A5	Switzerland
Opt. A6	Japan
Opt. A10	China
Opt. A11	India
Opt. A12	Brazil
Opt. E1	Euro and UK power cords

### Service Options\*17

Option	Description
Opt. CA1	Single Calibration or Functional Verification
Opt. R5	Repair Service 5 Years (including warranty)
Opt. SILV100	Standard Warranty Extended to 5 Years

\*17 Test Leads and accessories are not covered by the DMM warranty and Service Offerings. Refer to the datasheet of each Test Lead and accessory model for its unique warranty and calibration terms.

### Recommended Accessories and Software

Accessory	Description
Calibration Manual	077-0362-xx
Programmer's Manual	077-0363-xx
TP750	100 Ω RTD Temperature Probe (DMM4050 only)
196-3520-xx	Premium Test Leads (replacement/spare for TL710)
TL705	2×4 Wire Ohm 1000 V Precision Test Lead
TL725	2×4 Wire Ohm SMD Test Tweezers
ACD4000	Soft Transit Case
HCTEK4321	Hard Carrying Case
RMU2U	Rackmount Shelf Kit for 1 or 2 Units
013-0369-xx	Calibration Fixture 4-terminal short
196-3520-00	TL710 Premium Test Lead
SIGEXPTE	NI LabVIEW SignalExpress Tektronix Edition Software – Full Version



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Product(s) complies with IEEE Standard 488.1-1987 and RS-232C.







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