

# NI 4065 Specifications

## 6½-Digit Digital Multimeter



**Caution** Measurement probes are not shielded and can act as antennas. As a result, attaching measurement probes in an environment with electromagnetic interference present may reduce measurement accuracy.



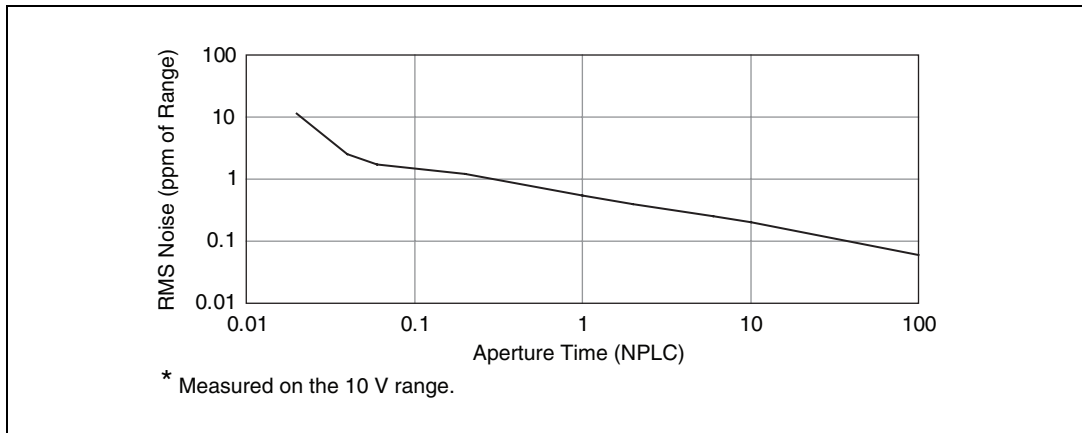
**Note** All specifications in this document are subject to change without notice. For the most current specifications, visit [ni.com/manuals](http://ni.com/manuals). All accuracy specifications apply to the 6½ digit resolution setting at 6 samples/second (S/s).

## DC Specifications

Resolution (Digits)	Reading Rate* (S/s)	Aperture Time (NPLC)	RMS Noise† (ppm of range)
6½	0.6 (0.5)	100	0.06
	6 (5)	10	0.2
	10 (8.33)	6	0.25
5½	30 (25)	2	0.4
	60 (50)	1	0.55
	900	0.06	1.7
	1,500	0.04	2.5
4½	3,000	0.02	11.5

\* Specified for 60 Hz (and 50 Hz) operation.  
† Measured on the 10 V range.

## Noise Performance\*



## DC System Speeds

Range or function changes .....	10/s
Auto Range time, DC V .....	200 ms
Auto Range time, DC I .....	200 ms
Auto Range time, resistance .....	250 ms
Trigger latency .....	<1 $\mu$ s
Maximum trigger rate .....	>2.5 kHz

## DC Accuracy Specifications

DC Voltage  $\pm$  (ppm\* of reading + ppm of range)

Range	Resolution	Input <sup>†</sup> Resistance	24 Hr <sup>‡</sup> $T_{cal} \pm 1\text{ }^{\circ}\text{C}$	90 Day $T_{cal} \pm 5\text{ }^{\circ}\text{C}$	1 Year $T_{cal} \pm 5\text{ }^{\circ}\text{C}$	Tempco/ $^{\circ}\text{C}^{**}$
100 mV <sup>††</sup>	100 nV	>10 G $\Omega$ , 10 M $\Omega$	30 + 30	65 + 35	90 + 35	5 + 2
1 V	1 $\mu$ V	>10 G $\Omega$ , 10 M $\Omega$	20 + 6	65 + 7	90 + 7	5 + 1
10 V	10 $\mu$ V	>10 G $\Omega$ , 10 M $\Omega$	15 + 5	65 + 6	90 + 6	5 + 1

Range	Resolution	Input <sup>†</sup> Resistance	24 Hr <sup>‡</sup> T <sub>cal</sub> ±1 °C	90 Day T <sub>cal</sub> ±5 °C	1 Year T <sub>cal</sub> ±5 °C	Tempco/°C <sup>**</sup>
100 V	100 µV	10 MΩ	20 + 6	75 + 7	110 + 7	9 + 1
300 V	1 mV	10 MΩ	20 + 20	75 + 20	110 + 20	9 + 1

\* 1 part per million (ppm) = 0.0001%.

<sup>†</sup> Default input resistance is 10 MΩ.

<sup>‡</sup> Relative to external calibration source. DMM must remain powered on.

\*\* Tempco values are valid within the device's ambient temperature range. Refer to the *Operating Environment* section of this document for temperature ranges.

<sup>††</sup> With offset nulling.

T<sub>cal</sub> = temperature at which last external calibration was performed. NI factory calibration is 23 °C ± 1 °C.

Tempco = temperature coefficient.

### DC Current ± (ppm of reading + ppm of range)

Range	Resolution	Typical Burden Voltage	24 Hr <sup>*</sup> T <sub>cal</sub> ±1 °C	90 Day T <sub>cal</sub> ±5 °C	1 Year T <sub>cal</sub> ±5 °C	Tempco/°C <sup>†</sup>
10 mA	10 nA	<60 mV	50 + 100	300 + 200	500 + 200	30 + 20
100 mA	100 nA	<0.6 V	100 + 40	300 + 50	500 + 50	30 + 5
1 A	1 µA	<0.35 V	500 + 60	800 + 100	1,000 + 100	65 + 10
3 A	3 µA	<1 V	1,000 <sup>‡</sup> + 200	1,200 <sup>‡</sup> + 200	1,200 <sup>‡</sup> + 200	65 + 20

\* Relative to external calibration source. DMM must remain powered on.

<sup>†</sup> Tempco values are valid within the device's ambient temperature range. Refer to the *Operating Environment* section of this document for temperature ranges.

<sup>‡</sup> Add 650 ppm/A of reading for currents above 1.5 A.

T<sub>cal</sub> = temperature at which last external calibration was performed. NI factory calibration is 23 °C ± 1 °C.

Tempco = temperature coefficient.

### Resistance\* (4-Wire and 2-Wire) ± (ppm of reading + ppm of range)

Range	Resolution	Nominal Test Current	24 Hr <sup>†</sup> T <sub>cal</sub> ±1 °C	90 Day T <sub>cal</sub> ±5 °C	1 Year T <sub>cal</sub> ±5 °C	Tempco/°C <sup>‡</sup>
100 Ω	100 µΩ	1 mA	30 + 30	95 + 40	110 + 40	8 + 3
1 kΩ	1 mΩ	1 mA	20 + 6	95 + 10	110 + 10	8 + 1
10 kΩ	10 mΩ	100 µA	20 + 6	95 + 10	110 + 10	8 + 1
100 kΩ	100 mΩ	10 µA	20 + 6	95 + 10	110 + 10	8 + 1
1 MΩ	1 Ω	5 µA	20 + 10	110 + 12	125 + 12	10 + 1

Range	Resolution	Nominal Test Current	24 Hr <sup>†</sup> T <sub>cal</sub> ±1 °C	90 Day T <sub>cal</sub> ±5 °C	1 Year T <sub>cal</sub> ±5 °C	Tempco/°C <sup>‡</sup>
10 MΩ**	10 Ω	500 nA	150 + 10	400 + 12	500 + 12	30 + 2
100 MΩ**	100 Ω	500 nA  10 MΩ	2,000 + 20	6,000 + 40	8,000 + 40	400 + 4

\* Specifications are for 4-wire measurements. For 2-wire measurements perform offset nulling or add 200 mΩ to specification.  
<sup>†</sup> Relative to external calibration source. DMM must remain powered on.  
<sup>‡</sup> Tempco values are valid within the device's ambient temperature range. Refer to the *Operating Environment* section of this document for temperature ranges.  
\*\* 2-wire resistance measurement only.  
For relative humidity >80%, add 100 ppm/MΩ.  
T<sub>cal</sub> = temperature at which last external calibration was performed. NI factory calibration is 23 °C ± 1 °C.  
Tempco = temperature coefficient.

### Diode Test\*

Range	Resolution	Nominal Test Current	Accuracy
10 V	10 μV	100 μA, 1 mA <sup>†</sup>	Add 50 ppm of range and 50 ppm of reading to 10 V DC voltage specifications.

\* Can be used to test p-n junctions, LEDs, or zener diodes up to 10 V.  
<sup>†</sup> Up to 3.5 V measurement for 1 mA test current.

## DC Functions General Specifications

Overrange .....105% of range except  
300 V and 3 A range

Maximum 4-wire lead resistance.....Use the lesser of 10% of range  
or 1 kΩ

DC voltage input bias current.....<40 pA at 23 °C (typical)

Effective Common-Mode Rejection Ratio (CMRR)  
(1 kΩ resistance in LO lead).....>150 dB\* second-order DC noise  
rejection, 12 PLC aperture

### Normal-Mode Rejection Ratio (NMRR)

Aperture Time (NPLC)	DC Noise Rejection	Normal Mode Rejection
1	Normal	60 dB*
2	Second-order	>85 dB*
10		

\* For power-line frequency ± 0.1%.

# AC Specifications

Desired Bandwidth	Recommended Reading Rate	Resolution (Digits)
10 Hz to 100 kHz	1 S/s	6½
100 Hz to 100 kHz	10 S/s	5½
500 Hz to 100 kHz	100 S/s	4½

## AC System Speeds

Range or function changes ..... 10/s

Trigger latency ..... <1 µs

Maximum trigger rate ..... 2.5 kHz

## AC Accuracy Specifications



**Note** All AC accuracy specifications apply to signal amplitudes greater than 2% of range.

### AC Volts (% of reading + % of range)

Range (Peak Voltage)	Frequency	24 Hr T <sub>cal</sub> ±1 °C	90 Day T <sub>cal</sub> ±5 °C	1 Year T <sub>cal</sub> ±5 °C	Tempco/°C*
200 mV (±320 mV), 2 V (±3.2 V), 20 V (±32 V), 300 V (±425 V)	10 Hz to 40 Hz	1.5 + 0.04	2 + 0.05	2 + 0.05	0.01 + 0.003
	> 40 Hz to 20 kHz	0.2 + 0.04	0.2 + 0.05	0.2 + 0.05	0.01 + 0.003
	> 20 kHz to 50 kHz	0.3 + 0.04	0.3 + 0.05	0.3 + 0.05	0.01 + 0.003
	> 50 kHz to 100 kHz	1.5 + 0.08	1.5 + 0.08	1.5 + 0.08	0.02 + 0.005

\* Tempco values are valid within the device's ambient temperature range. Refer to the [Operating Environment](#) section of this document for temperature ranges.  
T<sub>cal</sub> = temperature at which last external calibration was performed. NI factory calibration is 23 °C ± 1 °C.  
Tempco = temperature coefficient.

## AC Current (% of reading + % of range)

Range (Peak Current)	Frequency	24 Hr $T_{cal} \pm 1\text{ }^{\circ}\text{C}$	90 Day $T_{cal} \pm 5\text{ }^{\circ}\text{C}$	1 Year $T_{cal} \pm 5\text{ }^{\circ}\text{C}$	Tempco/ $^{\circ}\text{C}^*$
10 mA ( $\pm 16$ mA), 100 mA ( $\pm 160$ mA), 500 mA ( $\pm 780$ mA), 3 A ( $\pm 4.25$ A)	10 Hz to 40 Hz	1.6 + 0.05	2.1 + 0.05	2.1 + 0.05	0.015 + 0.03
	> 40 Hz to 5 kHz	0.3 + 0.05	0.3 + 0.06	0.3 + 0.06	0.015 + 0.03

\* Tempco values are valid within the device's ambient temperature range. Refer to the *Operating Environment* section of this document for temperature ranges.  
 $T_{cal}$  = temperature at which last external calibration was performed. NI factory calibration is  $23\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ .  
 Tempco = temperature coefficient.

## High Crest Factor Additional Error\*

Crest Factor	Additional Error (% of reading)
1–3	0.05%
3–4	0.1%
4–5	1% <sup>†</sup>

\* Applicable for non-sinewave signals up to the rated peak voltage/current or bandwidth.  
<sup>†</sup> For frequencies above 2 kHz.

## AC Functions General Specifications

Input impedance ..... 10 M $\Omega$  in parallel with 200 pF

Input coupling ..... AC coupling

Maximum Volt-Hertz product .....  $3 \times 10^7$  V-Hz

Maximum DC voltage component ..... 250 V

CMRR

(1 k $\Omega$  resistance in LO lead) ..... >70 dB (DC to 60 Hz)

Overrange ..... 105% of range except  
300 V, 3 A range

# General Specifications

Maximum common-mode voltage ..... 300 V AC<sub>rms</sub> or DC

Measurement Category ..... II



**Note** Refer to the *Read Me First: Safety and Radio-Frequency Interference* document for definitions of Measurement Categories and other safety information.

## Input protection

DC I and AC I ..... 3.15 Amp, fused  
F 3.15 A 250 V, Fast-Acting  
user-replaceable fuse

Resistance, Diode ..... Up to 300 V DC

DC V, AC V ..... Up to 300 V DC, 300 V AC<sub>rms</sub>,  
450 V AC peak

Calibration interval ..... 1 year recommended

## Triggers

### Input triggers

Types ..... Trigger, Sample Trigger  
(programmable edge)

Sources ..... Auxiliary connector  
(AUX I/O connector),  
PXI Trigger lines (PXI only)

Minimum pulse width ..... 200 ns

Max samples per trigger .....  $2.1 \times 10^9$

Trigger delay ..... 0 to 149 s

Logic level ..... 5 V TTL, LVTTTL

### Output Triggers

Types ..... Measurement Complete  
(programmable edge)

Destinations ..... Auxiliary connector  
(AUX I/O connector),  
PXI Trigger lines (PXI only)

Pulse width ..... 1  $\mu$ s

Logic level.....3.3 V



**Note** The AUX I/O connector is not isolated. It is not referenced to your measurement circuit. The connector is referenced to the ground of your computer. The digital signals on this connector should not operate beyond -0.5 to 5.5 V of your computer ground. The trigger signals are TTL-compatible.

Power consumption

PXI devices.....<3 W from PXI backplane

**PXI Power Consumption**

Rail Voltage	Current Consumption	Power Consumption
12 V	10 mA	0.12 W
5.0 V	300 mA	1.50 W
3.3 V	150 mA	0.50 W

PCI/PCI Express devices .....<3 W from PCI/PCI Express motherboard

USB devices ..... 2 W maximum from USB port

Input voltage at USB device.....4.5 V to 5.25 V

Maximum inrush current .....500 mA

Typical current .....400 mA maximum

Suspend current .....500 uA typical average current, 1 sec averaging interval

Specification .....USB 2.0 Hi-speed or full-speed, Series B connector



**Note** The NI USB-4065 draws power directly from the USB port, so you do not need to connect external power.

Warm-up

PXI/PCI/PCI Express devices .....30 minutes to rated accuracy

USB devices .....50 minutes to rated accuracy

Dimensions

PXI devices.....3U, one slot, PXI/cPCI module;  
21.6 cm × 2.0 cm × 13.0 cm  
(8.5 in. × 0.8 in. × 5.1 in.)

PCI/PCI Express devices .....	One slot, PCI/PCI Express module; 18.3 cm × 2.0 cm × 12.0 cm (7.2 in. × 0.8 in. × 4.7 in.)
USB devices.....	17.8 cm × 10.4 cm × 3.3 cm (7.0 in. × 4.1 in. × 1.3 in.)

**Weight**

NI PXI-4065 .....	351.5 g (12.4 oz)
NI PCI/PCIe-4065.....	325 g (11.5 oz)
NI USB-4065 .....	281 g (9.9 oz)

**Environment**

Maximum altitude ..... 2,000 m (at 25 °C ambient temperature)

Pollution Degree ..... 2

Indoor use only.

**Operating Environment**

Ambient temperature range  
(Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)

PXI devices .....	0 to 55 °C
PCI/PCI Express devices .....	0 to 40 °C
USB devices.....	0 to 45 °C

Relative humidity range ..... Up to 90% at 40 °C

**Storage Environment**

Ambient temperature range..... –40 to 70 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)

Relative humidity range ..... 5% to 95% noncondensing  
(Tested in accordance with IEC 60068-2-56.)

## Shock and Vibration (PXI only)

Operational Shock .....	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)
Random Vibration	
Operating .....	5 Hz to 500 Hz, 0.3 g <sub>rms</sub>
Nonoperating .....	5 Hz to 500 Hz, 2.4 g <sub>rms</sub> (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

## Safety

The NI 4065 meets the requirements of the following standards of safety and electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1



**Notes** For UL and other safety certifications, refer to the product label, or visit [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A



**Note** For EMC compliance, operate this device according to product documentation.



**Note** The Declaration of Conformity (DoC) contains important, additional EMC information. To obtain the DoC for this product, visit [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; Electromagnetic Compatibility Directive (EMC)



**Note** Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at [ni.com/environment](http://ni.com/environment). This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

## Waste Electrical and Electronic Equipment (WEEE)



**EU Customers** At the end of their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit [ni.com/environment/weee.htm](http://ni.com/environment/weee.htm).

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