USB-4065 Specifications

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Contents

USB-4065 Specifications

These specifications apply to the USB-4065.

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

Characteristics describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- **Typical** specifications describe the performance met by a majority of models.
- **Nominal** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are **Warranted** unless otherwise noted.

Conditions

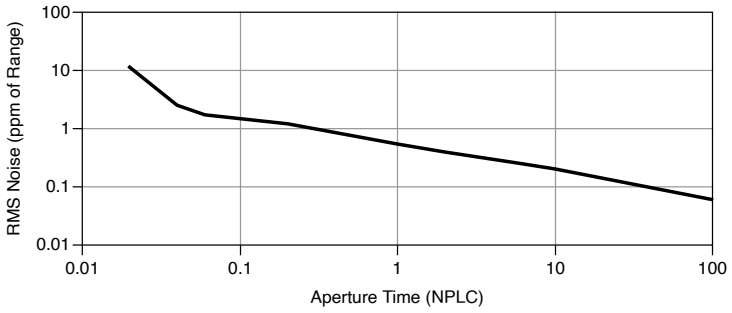
Specifications are valid under the following conditions unless otherwise noted.

- Ambient temperature of T_{cal} ± 5 °C.[1]
- Calibration interval of 1 year
- 50 minutes minutes warm-up time
- niDMM Digits Resolution property or NIDMM_ATTR_RESOLUTION_DIGITS attribute set to 6.5
- niDMM Aperture Time Units property or NIDMM_ATTR_APERTURE_TIME_UNITS attribute set to Power Line Cycles
- niDMM Aperture Time property or NIDMM_ATTR_APERTURE_TIME attribute set to 10

DC Specifications

Resolution (digits)	Reading rate (S/s), specified for 60 Hz (and 50 Hz) operation	Aperture time (NPLC)	RMS noise (ppm of range), 10 V 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

Figure 1. Noise Performance[2]



DC System Speed Characteristics

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 µs
Maximum trigger rate	2.5 kHz

DC Accuracy Specifications

Range	Resolution	Input resistance (10 MΩ, default), nominal	24 Hr [4] T_{cal} [5] ±1 °C	90 day T_{cal}±5 °C	1 year T_{cal} ±5 °C	Tempco[6](ppm/°C)
100 mV [3]	100 nV	>10 GΩ, 10 MΩ	30 + 30	65 + 35	90 + 35	5 + 2
1 V	1 µV	>10 GΩ, 10 MΩ	20 + 8	65 + 12	90 + 12	5 + 1
10 V	10 µV	>10 GΩ, 10 MΩ	15 + 7	65 + 12	90 + 12	5 + 1
100 V	100 µV	10 MΩ	20 + 8	75 + 12	110 + 12	9 + 1
300 V	1 mV	10 MΩ	20 + 24	75 + 40	110 + 40	9 + 1

Table 1. DC Voltage ± (ppm of Reading + ppm of Range)

Range	Resolution	Burden voltage, typical	24 Hr [4] T_{cal} [5] ±1 °C	90 day T_{cal}±5 °C	1 year T_{cal} ±5 °C	Tempco[6] (ppm/°C)
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[7] + 200	1,200[7] + 200	1,200[7] + 200	65 + 20

Table 2. DC Current ± (ppm of Reading + ppm of Range)

Range	Resolution	Test current, nominal	24 Hr [9] T_{cal} [10] ±1 °C	90 day T_{cal}±5 °C	1 year T_{cal} ±5 °C	Tempco[6] (ppm/°C)
100 Ω	100 µΩ	1 mA	30 + 30	95 + 40	110 + 40	8 + 3
1 kΩ	1 mΩ	1 mA	20 + 8	95 + 20	110 + 20	8 + 1

Range	Resolution	Test current, nominal	24 Hr [9] T_{cal} [10] ±1 °C	90 day T_{cal} ±5 °C	1 year T_{cal} ±5 °C	Tempco [6] (ppm/°C)
10 kΩ	10 mΩ	100 µA	20 + 8	95 + 20	110 + 20	8 + 1
100 kΩ	100 mΩ	10 µA	20 + 8	95 + 20	110 + 20	8 + 1
1 MΩ	1 Ω	5 µA	20 + 12	110 + 24	125 + 24	10 + 1
10 MΩ [11]	10 Ω	500 nA	150 + 12	400 + 24	500 + 24	30 + 2
100 MΩ [11]	100 Ω	500 nA|| 10 MΩ	2,000 + 24	6,000 + 60	8,000 + 60	400 + 4

Table 3. Resistance [8] (4-Wire and 2-Wire) ± (ppm of Reading + ppm of Range)

Range	Resolution	Test current, nominal	Accuracy
10 V	10 µV	100 µA, 1 mA (up to 3.5 V measurement for 1 mA test current)	Add 50 ppm of range and 50 ppm of reading to 10 V DC voltage specifications.

Table 4. Diode Test [12]

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 (for power-line frequency ±0.1%), 12 PLC aperture

Aperture time (NPLC)	DC noise rejection	Normal mode rejection (for power-line frequency ±0.1%)
1	Normal	60 dB

Aperture time (NPLC)	DC noise rejection	Normal mode rejection (for power-line frequency ±0.1%)
2	Second-order	>85 dB
10		

Table 5. Normal Mode Rejection Ratio (NMRR)

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 Speed Characteristics

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.

Range (peak voltage)	Frequency	24 hr[13] T_{cal} ±1 °C	1 year[14] T_{cal} ±5 °C	Tempco[15] (%/°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	0.01 + 0.003
	> 40 Hz to 20 kHz	0.2 + 0.04	0.2 + 0.05	0.01 + 0.003
	> 20 kHz to 50 kHz	0.3 + 0.04	0.3 + 0.05	0.01 + 0.003

Range (peak voltage)	Frequency	24 hr[13] T_{cal} ±1 °C	1 year[14] T_{cal} ±5 °C	Tempco[15] (%/°C)
	> 50 kHz to 100 kHz	1.5 + 0.08	1.5 + 0.08	0.02 + 0.005

Table 6. AC Voltage (% of Reading + % of Range)

Range (peak current)	Frequency	24 hr[13] T_{cal} ±1 °C	1 year[14] T_{cal} ±5 °C	Tempco[15] (%/°C)
10 mA (± 16 mA), 100 mA (± 160 mA), 500 mA (± 780 mA), 3 A (± 4.25 A)	10 Hz to 40 Hz	1.6 to 0.05	2.1 + 0.05	0.015 + 0.03
	> 40 Hz to 5 kHz	0.3 + 0.05	0.3 + 0.06	0.015 + 0.03

Table 7. AC Current (% of Reading + % of Range)

Crest factor	Additional error (% of reading)
1 to 3	0.05%
3 to 4	0.1%
4 to 5	1% (for frequencies above 2 kHz)

Table 8. High Crest Factor Additional Error[16]

AC Functions General Specifications

Input impedance	10 MΩ in parallel with 200 pF, nominal
Input coupling	AC coupling
Maximum Voltz-Hertz product	3×10^7 V-Hz
Maximum DC voltage component	250 V
CMRR, 1 kΩ resistance in LO lead	70 dB (DC to 60 Hz)
Overrange	105% of range except 300 V, 3 A range

Temperature Accuracy Specifications[17]

Type	Range	1 year T_{cal} ±5 °C		Tempco ($°C_{reading}/°C_{DMM}$) [20]	Resolution
		With Simulated Ref. Junction[18]	With PXI-2527[19]		
J	-150 to 1200	0.3	1.0	0.03	0.1
	-210 to -150	0.4	1.2	0.03	0.1
K	-100 to 1200	0.4	1.0	0.03	0.1
	-200 to -100	0.4	1.5	0.03	0.1
N	-100 to 1300	0.3	1.0	0.03	0.1
	-200 to -100	0.6	1.5	0.03	0.1
T	-100 to 400	0.3	1.0	0.03	0.1
	-200 to -100	0.4	1.5	0.03	0.1
E	-150 to 1000	0.2	1.0	0.03	0.1
	-200 to -150	0.3	1.5	0.03	0.1
R	300 to 1760	0.6	1.8	0.06	0.1
	-50 to 300	1.4	1.9	0.06	0.1
S	400 to 1760	0.7	1.8	0.06	0.1
	-50 to 400	1.3	1.8	0.06	0.1
B	1100 to 1820	0.6	1.8	0.09	0.1
	400 to 1100	1.4	1.9	0.09	0.1

Table 9. Thermocouple Temperature Accuracy Specifications (°C)

Range	1 year T_{cal}[18] ±5 °C	Tempco/°C [22]	Resolution
-200 to 600	0.17	0.011	0.01

Table 10. RTD[21] Temperature Accuracy Specifications (°C)

Range	1 year T_{cal}[18] ±5 °C	Tempco/°C [22]	Resolution
-80 to 150	0.08	0.002	0.01

Table 11. Thermistor Temperature Accuracy Specifications (°C)

General Specifications

Maximum common-mode voltage	300 V AC_{rms} or DC
Measurement Category	II

> **Caution** Do not use this device for connection to signals or for measurements within Measurement Categories III or IV.

Input Protection Characteristics

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_{rms}, 450 V AC peak

> **Fuse** When this fuse symbol is marked on a device, take proper precautions.

> **Hazardous Voltage** This icon denotes a warning advising you to take precautions to avoid electrical shock.

Calibration Interval

Calibration interval	1 year recommended

Warm-Up Time Characteristics

Warm-up time	50 minutes to rated accuracy

Trigger Characteristics

Input triggers

Types	Trigger, Sample Trigger (programmable edge)
Sources	Auxiliary connector (AUX I/O connector)
Minimum pulse width	200 ns
Max samples per trigger	2.1×10^9
Trigger delay	0 to 149 s
Logic level	5 V TTL, LVTTL

Output triggers

Types	Measurement Complete (programmable edge)
Destinations	Auxiliary connector (AUX I/O connector)
Pulse width	1 µs
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

chassis. The digital signals on this connector should not operate beyond -0.5 to 5.5 V of your chassis ground. The trigger signals are TTL-compatible.

Power Consumption Characteristics

Power consumption	
Input voltage at USB device	4.5 V to 5.25 V
Maximum inrush current	500 mA
Operating current	400 mA maximum
Suspend current	500 µA typical average current, 1 sec averaging interval
USB standard	USB 2.0 hi-speed or full-speed

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

Physical Characteristics

Dimensions	17.8 cm x 10.4 cm x 3.3 cm (7.0 in. × 4.1 in. × 1.3 in.)
Weight	281 g (9.9 oz)

Cleaning Statement

> **Notice** Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

Environment

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

Indoor use only.

Operating Environment

Ambient temperature range	0 to 45 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)
Relative humidity range	10% to 90%, noncondensing

Storage Environment

Ambient temperature range	-40 °C 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.)

Compliance and Certifications

> **Caution** You can impair the protection provided by the USB-4065 if you use it in a manner not described in this document.

> **Caution** This product is intended for use in industrial locations. As a result, this product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Safety Compliance Standards

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

> **Note** For safety certifications, refer to the product label or the Product Certifications and Declarations section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions

- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

> **Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia, and New Zealand (per CISPR 11), Class A equipment is intended for use only in heavy-industrial locations.

> **Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

> **Note** For EMC declarations, certifications, and additional information, refer to the Product Certifications and Declarations section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)
- 2014/53/EU; Radio Equipment Directive (RED)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the **Engineering a Healthy Planet** web page at 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.

EU and UK Customers

- **Waste Electrical and Electronic Equipment (WEEE)**—At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）

- **中国 RoHS**— NI 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 NI 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

[1] T_{cal} = temperature at which last external calibration was performed. NI factory calibration is 23 °C ± 1 °C.

[2] Measured on the 10 V range.

[3] With offset nulling.

[4] Relative to external calibration source. DMM must remain powered on.

[5] T_{cal} is the temperature at which last external calibration was performed. NI factory calibration is 23°C ±1°C.

[6] Tempco is the temperature coefficient in ppm of range per degree Celsius.

[7] Add 650 ppm/A of reading for currents above 1.5 A.

[8] Specifications are for 4-wire measurements. For 2-wire measurements, perform offset nulling or add 200 mΩ to specification. For relative humidity >80%, add 100 ppm/MΩ.

[9] Relative to external calibration source. DMM must remain powered on.

[10] T_{cal} is the temperature at which last external calibration was performed. NI factory calibration is 23°C ±1°C.

[11] 2-wire resistance measurement only.

[12] Can be used to test p-n junctions, LEDs, or zener diodes up to 10 V.

[13] T_{cal} is the temperature at which last external calibration was performed. NI factory calibration is 23°C ±1 °C.

[14] Use the 1 Year specification to calibrate on a 90-day cycle.

[15] Tempco is the temperature coefficient. Tempco values are valid within the device's ambient temperature range.

[16] Applicable for non-sinewave signals up to the rated peak voltage, current, or bandwidth.

[17] T_{cal} = temperature at which last external calibration was performed. NI factory calibration is 23°C±1 °C. For total measurement accuracy, add temperature probe error.

[18] Using simulated reference junction.

[19] Includes PXI 2527 with TB 2627 with a typical 0.5 °C CJC error and a typical thermal EMF offset of 2.5 µV for CJC temperatures between 15 °C and 35 °C. Add an additional 0.5 °C uncertainty when CJC is in the range 0 °C to 15 °C or 35 °C to 50 °C.

[20] Tempco = Temperature coefficient, expressed in degrees of measurement uncertainty per degree change in DMM instrument operating temperature.

[21] RTD with R_O = 100 Ω Pt3851 RTD in a 4-wire configuration, using lowest possible resistance range for each temperature.

[22] Tempco is the temperature coefficient, expressed in degrees of measurement uncertainty per degree change in DMM instrument operating temperature.