Specifications for the NI PXI-4070

6½ Digit FlexDMM™ and 1.8 MS/s Isolated Digitizer

For the most current specifications, visit `ni.com/instruments`.

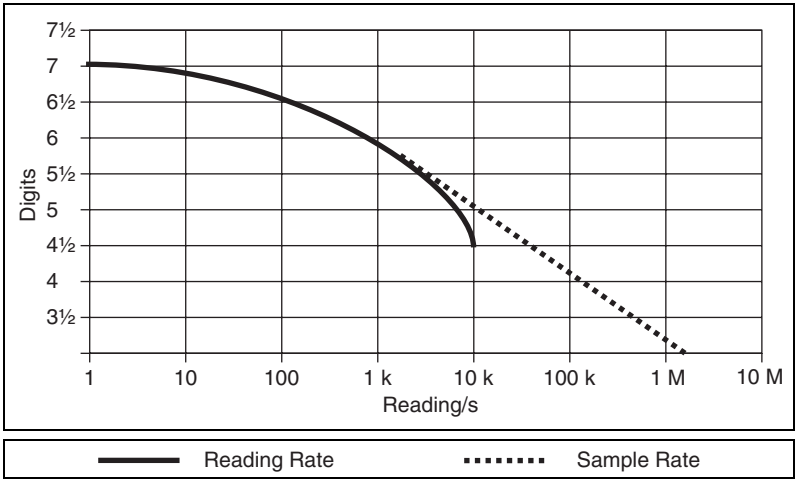
Note All specifications in this document are subject to change without notice.

DC Specifications

Digits	Bits	Max Sample Rate[1]	Reading Rate[2]
7	23	5 S/s	5 S/s
6½	22	100 S/s	100 S/s
5½	18	5 kS/s	3 kS/s
4½	15	20 kS/s	10 kS/s
3	10	1.8 MS/s	N/A

[1] Maximum sample rates refer to waveform acquisition.
[2] Autozero disabled, except 7 digits, measured on a 10 V and 10 kΩ range.

DC Voltage Maximum Reading Rate



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DC System Speeds

Range or function change 100/s

Autorange time, DC V and DC I .....5 ms

Autorange time, resistance .....50 ms

Trigger latency.....2 µs

Maximum trigger rate.....6 kHz

DC Accuracy Specifications

Note All DC accuracy specifications apply to 6½ digit resolution (≥1 PLC), autozero and ADC calibration enabled.

DC Voltage ± (ppm[1] of reading + ppm of range)

Range	Resolution	Input Resistance	24 Hr[2] T_{cal} ± 1 °C	90 Day[3] T_{cal} ± 5 °C	2 Year[3] T_{cal} ± 5 °C	Tempco/°C (0 °C to 50 °C)	
						Without Self-Cal	With Self-Cal
100 mV†	100 nV	>10 GΩ,10 MΩ	10 + 10	30 + 20	40 + 20	4 + 5	0.3 + 0.3
1 V	1 µV	>10 GΩ,10 MΩ	6 + 2	20 + 6	25 + 6	2 + 1	0.3 + 0.3
10 V	10 µV	>10 GΩ,10 MΩ	4 + 2	20 + 6	25 + 6	1 + 1	0.3 + 0.3
100 V	100 µV	10 MΩ	6 + 2	30 + 6	35 + 6	4 + 1	0.3 + 0.3
300 V	1 mV	10 MΩ	6 + 6	30 + 20	35 + 20	4 + 3	0.3 + 0.3

[1] 1 ppm (part per million) = 0.0001%.
[2] Relative to external calibration source.
[3] Using internal self-calibration; specifications valid over the entire operating temperature range.
† With offset nulling and 100 ms aperture.
T_{cal} = temperature at which last self-calibration or external calibration was performed.
Tempco = temperature coefficient.

DC Current[1] ± (ppm of reading + ppm of range)

Range	Resolution	Burden Voltage (typical)	Noise (ppm of range rms)	2 Year (0 °C to 50 °C)	Tempco/°C (0 °C to 50 °C)
20 mA	10 nA	<20 mV	20	400 + 75	8 + 1
200 mA	100 nA	<200 mV	3	400 + 20	8 + 0.2
1 A	1 µA	<800 mV	3	500 + 20	8 + 0.4

[1] Typical 24 hour accuracy (23 °C ± 1 °C) is ± (50 ppm of reading + 5 ppm of range).

Resistance (4-Wire and 2-Wire[1]) ± (ppm of reading + ppm of range)

Range	Resolution	Test Current[2]	Max Test Voltage	24 Hr[3] T_{cal} ± 1 °C	90 Day[4] T_{cal} ± 5 °C	2 Year[4] T_{cal} ± 5 °C	Tempco/°C (0 °C to 50 °C)	
							Without Self-Cal	With Self-Cal
100 Ω†	100 µΩ	1 mA	100 mV	15 + 10	50 + 10	80 + 10	8 + 1	0.8 + 1
1 kΩ†	1 mΩ	1 mA	1 V	12 + 2	50 + 3	80 + 3	8 + 0.1	0.8 + 0.1
10 kΩ†	10 mΩ	100 µA	1 V	12 + 2	50 + 3	80 + 3	8 + 0.1	0.8 + 0.1
100 kΩ	100 mΩ	10 µA	1 V	12 + 2	50 + 6	80 + 6	8 + 0.5	0.8 + 0.5
1 MΩ	1 Ω	10 µA	10 V	20 + 2	60 + 10	90 + 10	8 + 1	0.8 + 1
10 MΩ	10 Ω	1 µA	10 V	100 + 2	200 + 10	400 + 10	30 + 3	30 + 3
100 MΩ‡	100 Ω	1 µA‖10 MΩ	10 V	900 + 20	1,800 + 40	2,000 + 40	200 + 10	200 + 10

[1] Perform offset nulling or add 200 mΩ to reading.
[2] –10% to 0% tolerance.
[3] Relative to external calibration source.
[4] Using internal self-calibration; specifications valid over the entire operating temperature range.
† With offset compensated ohms enabled.
‡ 2-wire resistance measurement only. Typical accuracy is 5% between 105 MΩ and 1.05 GΩ. Use tempco outside 18 °C to 28 °C.
T_{cal} = temperature at which last self-calibration or external calibration was performed.

Diode Test[1]

Range	Resolution	Test Current[2]	Accuracy
10 V	10 µV	1 µA, 10 µA, 100 µA, 1 mA†	Add 20 ppm of reading to 10 V DC voltage specifications.

[1] Can be used to test p-n junctions, LEDs, or zener diodes up to 10 V.
[2] –10% to 0% tolerance.
† Up to 4.5 V measurement for 1 mA test current.

Additional Noise Errors for DC Voltage, Current, Resistance

Resolution	Additional Noise Error
5½ digits	10 ppm of range
4½ digits	100 ppm of range
3½ digits	1,000 ppm of range

DC Functions General Specifications

Effective Common-Mode Rejection Ratio (CMRR)
(1 kΩ resistance in LO lead).....>170 dB (DC, >46 Hz), with high-order DC noise rejection, 100 ms aperture

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

Overrange .....105% of range except 300 V and 1 A range

DC voltage input bias current.....<30 pA at 23 °C (typical)

Normal-Mode Rejection Ratio (NMRR)

Readings/s	NMRR	Conditions
10	>100 dB†	All noise sources >46 Hz
50 (60)	>60 dB‡	50 (60) Hz ± 0.1%

† With high-order DC noise rejection;100 ms aperture.
‡ With normal DC noise rejection; 20 ms (16.67 ms) aperture.

AC Specifications

Note All AC speed specifications apply with autozero disabled.

Digits	Reading Rate	Bandwidth
6½	0.25 S/s	1 Hz to 300 kHz
6½	2.5 S/s	10 Hz to 300 kHz
6½	25 S/s	100 Hz to 300 kHz
6½	100 S/s	400 Hz to 300 kHz
5½	1 kS/s	20 kHz to 300 kHz

AC System Speeds

Range or function change 10/s

Autorange time, AC V and AC I..... 250 ms

Trigger latency ..... 2 µs

Maximum trigger rate ..... 1 kHz

AC Accuracy Specifications

Note All AC accuracy specifications apply to 6½ digit resolution, signal amplitudes greater than 1% of range, and autozero enabled.

AC Voltage[1] 2 Year ± (% of reading + % of range), 23 °C ± 5 °C

Range (rms)	Peak Voltage	Resolution	1 Hz to 40 Hz[2]	40 Hz to 20 kHz	20 kHz to 50 kHz	50 kHz to 100 kHz	100 kHz to 300 kHz
50 mV[†]	±105 mV	100 nV	0.1 + 0.04	0.05 + 0.04	0.09 + 0.04	0.5 + 0.08	3 + 0.1
500 mV	±1.05 V	1 µV	0.1 + 0.01	0.05 + 0.02	0.09 + 0.02	0.5 + 0.02	3 + 0.05
5 V	±10.5 V	10 µV					
50 V	±105 V	100 µV					
300 V	±450 V	1 mV					
Tempco/°C (0 °C to 50 °C)			0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.001 + 0.001	0.01 + 0.01

[1] After self-calibration. Measurement aperture greater than $4/f_L$, where f_L is the lowest frequency component of the signal being measured.
[2] Specification applies for DC coupling.
[†] Applies to signals >2 mV.

AC Current[1] 2 Year ± (% of reading + % of range), 0 °C to 50 °C

Range (rms)	Peak Current	Resolution	Burden Voltage (rms)	1 Hz to 20 kHz[2]	Tempco/°C (0 °C to 50 °C)
10 mA[†]	±20 mA	10 nA	<10 mV	0.04 + 0.02	0.001 + 0.0001
100 mA	±200 mA	100 nA	<100 mV	0.04 + 0.02	0.001 + 0.0001
1 A	±2 A	1 µA	<800 mV	0.1 + 0.02	0.001 + 0.0001

[1] Measurement aperture greater than $4/f_L$, where f_L is the lowest frequency component of the signal being measured.
[2] Specification is typical for the 5 kHz to 20 kHz frequency range.
[†] Applies to signals >200 µA.

Note There is no degradation in accuracy due to crest factor for signals up to the rated peak voltage/current or bandwidth. For high crest factor signals, increase range. For example, for a 500 mV_{rms} signal with a crest factor between 2 and 10, use the 5 V range.

AC Functions General Specifications

Input impedance .....1 MΩ in parallel with 120 pF

Input coupling.....AC or DC coupling

Maximum Volt-Hertz product .....$>8 \times 10^7$ 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 on 300 V and 1 A ranges

Frequency and Period[1]

Input Range	Frequency Range	Period Range	Resolution	2 Year Accuracy[2] 0 °C to 50 °C ±% of reading
50 mV to 300 V	1 Hz to 500 kHz	1 s to 2 µs	6½ digits	0.01

[1] 2 second gate time; input signal must be >10% of AC voltage input range.
[2] 0.0025% of reading typical.

Isolated Digitizer Specifications

Acquisition System

Available sample rates..... $\frac{1.8\ \text{MS/s}}{n}$,

where n = 1, 2, 3,…1.8×10^5

Variable resolution .....10 bits to 23 bits; refer to the *Digitizer Maximum Sampling Rate* graph

Available functions.....Voltage and current

Voltage ranges .....±100 mV to ±300 V (DC or AC coupled)

Current ranges.....20 mA to 1 A

Maximum record duration .....140 s

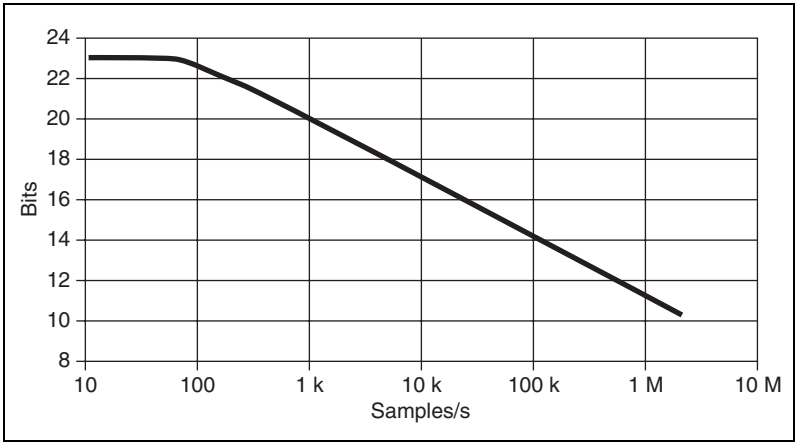
Timebase accuracy.....25 ppm

Trigger

Latency..... 1.8 µs

Jitter ..... <600 ns

Digitizer Maximum Sampling Rate



Isolated Digitizer Accuracy Specifications

Note All digitizer accuracy specifications apply to autozero enabled, DC coupling, after self-calibration, and 1.8 MS/s sampling rate.

Voltage ± (ppm of reading + ppm of range)

Range	Input Impedance[1]	2 Year T_{cal} ± 5 °C	Flatness Error[2] 20 kHz	Bandwidth[2, 3] (–3 dB)	THD[2] 1 kHz signal, –1 dBfs	THD[2] 20 kHz signal, –1 dBfs	Tempco/°C (0 °C to 50 °C)
100 mV[†]	>10 GΩ 1 MΩ	45 + 30	–0.03 dB	300 kHz	–104 dB	–78 dB	4 + 6
1 V	>10 GΩ 1 MΩ	35 + 6	–0.03 dB	300 kHz	–109 dB	–83 dB	3 + 1
10 V	>10 GΩ 1 MΩ	30 + 6	–0.03 dB	300 kHz	–96 dB	–70 dB	3 + 1
100 V	1 MΩ	45 + 6	–0.03 dB	300 kHz	–96 dB	–70 dB	7 + 1
300 V	1 MΩ	45 + 30	–0.03 dB	300 kHz	–98 dB	–72 dB	7 + 3

[1] In parallel with 120 pF.
[2] Typical specification.
[3] The AC coupling low frequency (–3 dB) point is 0.8 Hz.
[†] With offset nulling.
T_{cal} = temperature at which last self-calibration or external calibration was performed.

Current ± (ppm of reading + ppm of range)

Range	Resolution	Burden Voltage (typical)	2 Year (0 °C to 50 °C)	Flatness Error[1] 20 kHz	Bandwidth[1] (–3 dB)	Tempco/°C (0 °C to 50 °C)
20 mA	10 nA	<20 mV	400 + 75	±0.01 dB	430 kHz	8 + 1
200 mA	100 nA	<200 mV	400 + 20	±0.01 dB	430 kHz	8 + 0.2
1 A	1 µA	<800 mV	500 + 20	±0.01 dB	400 kHz	8 + 0.4

[1] Typical specification.

General Specifications

Self-calibration .....Calibrates the FlexDMM relative to high-precision internal voltage and resistance standards. No external calibration equipment required.

Input protection

- Resistance, diode .....Up to 300 V DC
- DC V, AC V .....Up to 300 V DC, 300 V AC_{rms}, 450 V AC peak
- DC I and AC I.....1.25 A, 250 V fast-acting user replaceable fuse

Maximum common-mode voltage.....300 V

Input terminals .....Gold-plated low-thermal EMF solid copper

Measurement complete trigger pulse width.....3 µs

Input trigger pulse width.....1 µs, with <2 m cable

External calibration interval .....2 year recommended

Power consumption .....<12 W from PXI backplane

Operating environment .....0 °C to 50 °C, up to 80% RH at 35 °C

Storage environment.....–40 °C to 70 °C

Warm-up .....1 hour to rated accuracy

Dimensions, weight..... 10 cm × 16 cm (3.9 in. × 6.33 in.), 340 g (12 oz)

Installation Category II

Pollution Degree 2

Caution The AUX I/O connector is not isolated. It is not referenced to your measurement circuit. It 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.

Safety

The NI PXI-4070 meets the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1

Note For UL and other safety certifications, refer to the product label or to `ni.com`.

Electromagnetic Compatibility

Emissions ..... EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity ..... EN 61326:1997 + A2:2001, Table 1

EMC/EMI..... CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For EMC compliance, you *must* operate this device with shielded cabling.

CE Compliance

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

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility
Directive (EMC).....89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declarations of Conformity Information** at `ni.com/hardref.nsf/`. This Web site lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link appears to the DoC in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.