NI 5102 Specifications

15 MHz, 20 MS/s Digitizer

This document lists the specifications of NI PXI/PCI/USB/PCMCIA-5102 high-speed digitizers. These specifications are typical at 25 °C unless otherwise stated. The operating range is 0 °C to 50 °C. All specifications are subject to change without notice.

Note Visit `ni.com/manuals` for the most current specifications and product documentation.

Input Characteristics

Number of input channels ..... 2 single-ended, simultaneously sampled

- NI PXI/PCI/USB-5102
  Input impedance ..... 1 MΩ ±1% in parallel with 25 pF ±10 pF (Impedance increases with attenuating probes) CH 0, CH 1, TRIG

- NI PCMCIA-5102
  Input impedance ..... 1 MΩ ±1% in parallel with 40 pF ±10 pF (Impedance increases with attenuating probes) CH 0, CH 1, TRIG

ADC resolution ..... 8 bits

Maximum sample rate

Internal ..... 20 MS/s each channel in real-time sample mode

External sample clock ..... 20 MS/s

Minimum high or low time..... 24 ns

Random interleaved sampling (RIS) sample mode ..... 1 GS/s

Minimum sample rate ..... 1 kS/s (internal/external)

Maximum input range ..... ±50 V, DC + peak AC < 15 MHz (with X10 probe)
±5 V, DC + peak AC < 15 MHz (with X1 probe)

Input signal ranges (CH 0, CH 1) (without probe attenuation) ..... ±5 V at gain of 1
±1 V at gain of 5
±0.25 V at gain of 20
±50 mV at gain of 100

Input coupling ..... AC or DC, software-selectable

Overvoltage protection ..... ±42 V (DC + peak AC < 10 kHz without external attenuation)
CH 0, CH 1, TRIG only

Onboard FIFO memory depth ..... 663,000 samples per channel

Max waveform buffer ..... Up to 16 million samples per channel on NI PXI/PCI-5102 with bus mastering, depends on available host memory
663,000 samples per channel on NI PCMCIA/USB-5102

Data transfers ..... Programmed I/O supported on all boards; direct-to-memory burst transfers with PCI bus mastering on NI PXI/PCI-5102 only

Timebase System

Timebase ..... 20 MHz

Clock accuracy ..... 100 ppm

Interpolator resolution ..... 1 ns

External clock ..... RTSI<0..6> or PFI<1..2>; Frequency ≤20 MHz with a 50% duty cycle

Transfer Characteristics

Relative accuracy ..... ±1 LSB typical, ±1.8 LSB max

Differential nonlinearity..... ±0.3 LSB typical, ±0.5 LSB max

No missing codes ..... 8 bits guaranteed

Offset error after external calibration..... ±1.0% of full scale[1]

Gain error after external calibration..... ±1.5% of input signal[1]

DC accuracy ..... ±(1.5% of input signal + 1.0% of full scale)[1]

Dynamic Characteristics

Bandwidth

- Small signal (–3 dB) ..... 15 MHz typical
- Large signal (2% THD) ..... 10 MHz typical
- AC coupling low frequency cut-off..... 11 Hz (1.1 Hz with X10 probe)

Settling for full-scale step to ±1% full-scale range ..... 50 ns typical

System noise ..... 0.5 LSB rms typical

Crosstalk..... –60 dB

Interchannel skew ..... 1 ns

Aperture jitter..... 1 ns rms

Stability

Recommended warm-up time ..... 15 minutes

Offset temperature coefficient ..... (1 mV/gain + 200 µV)/ °C

Gain temperature coefficient..... 50 ppm/°C

Timebase accuracy ..... 100 ppm over operating temperature range

[1] Within ±1 °C of external calibration temperature

Triggering System

Analog

Source ..... CH 0, CH 1, TRIG

Level ..... 256 levels between ±full scale for CH 0 and CH 1; ±5 V for TRIG; software-selectable

Slope ..... Positive or negative, software-selectable

Resolution ..... 8 bits

Hysteresis ..... Software-programmable, up to full scale

Bandwidth ..... 15 MHz

Trigger holdoff ..... 800 ns to 6.71 seconds

Digital

Sources ..... PFI<1..2>, RTSI<0..6>

Compatibility ..... CMOS/TTL

Response ..... Rising or falling edge; software-selectable

Pulse width ..... 10 ns min

DC characteristics over operating range

Symbol	Parameter	Conditions	Min	Max
V_{IH}	Input HIGH voltage	—	2.0 V	V_{CC} + 0.5 V
V_{IL}	Input LOW voltage	—	–0.5	0.8 V
V_{OH}	Output HIGH voltage	I_{OH} = –4 mA I_{OH} = –16 mA I_{OH} = –10 µA	3.7 V 2.4 V V_{CC} – 0.1 V	—
V_{OL}	Output LOW voltage	I_{OL} = 16 mA I_{OL} = 10 µA	—	0.45 V 0.1 V

Symbol	Parameter	Conditions	Min	Max
C_{in}	Input capacitance (nominal)	—	—	10 pF
I_{OS}	Output short circuit current*	V_O = GND V_O = V_{CC}	–15 mA 40 mA	–120 mA 210 mA
* Only one output at a time; duration should not exceed 30 s.				

Power Requirements

NI PCI-5102—5 V DC (±5%) ..... 500 mA typical

NI PXI-5102—5 V DC (±5%) ..... 550 mA typical

NI PCMCIA-5102—5 V DC (±5%) ..... 260 mA typical, active 60 mA standby

NI USB-5102

External power supply ..... 4 W max

Physical Characteristics

PCMCIA card type..... Type II

Dimensions

NI PCI-5102 ..... 10.67 cm × 17.45 cm (4.2 × 6.87 in.)

NI PXI-5102 ..... 3U, One Slot, PXI/cPCI Module 2.0 × 13.0 × 21.6 cm (0.8 × 5.1 × 8.5 in.)

NI USB-5102 ..... 14.6 cm × 21.3 cm × 3.8 cm (5.8 × 8.4 × 1.5 in.)

Maximum Working Voltage

(Signal voltage plus common-mode voltage)

Channel to earth ..... 5 V, Measurement Category I

Channel to channel..... 5 V, Measurement Category I

Caution Do *not* use this module for connection to signals or for measurements within Categories II, III, or IV. Refer to the *Read Me First: Safety and Radio-Frequency Interference* document for more information on categories.

Environmental Characteristics

Operating temperature .....0 °C to 55 °C

Storage temperature .....–20 °C to 70 °C

Relative humidity .....10% to 90% noncondensing

Maximum altitude.....2,000 m

Pollution Degree 2

Indoor use only

Calibration

Internal.....Upon software command; adjusts timing for RIS acquisitions only

Interval.....1 week, or any time the operating environment changes

External.....Internal reference recalibrated

Interval.....1 year

Warm-up time.....15 minutes

Safety

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

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

Note For UL and other safety certifications, refer to the product label or visit `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 with RG223/U or equivalent shielded cable. Operate according to product documentation

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`, search by model number or product line, and click the appropriate link in the Certification column.

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`.

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`. If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at `ni.com/support` and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599,
Canada 800 433 3488, China 86 21 5050 9800,
Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,
Finland 385 (0) 9 725 72511, France 01 57 66 24 24,
Germany 49 89 7413130, India 91 80 41190000, Israel 972 3 6393737,
Italy 39 02 413091, Japan 81 3 5472 2970, Korea 82 02 3451 3400,
Lebanon 961 (0) 1 33 28 28, Malaysia 1800 887710,
Mexico 01 800 010 0793, Netherlands 31 (0) 348 433 466,
New Zealand 0800 553 322, Norway 47 (0) 66 90 76 60,
Poland 48 22 3390150, Portugal 351 210 311 210, Russia 7 495 783 6851,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151,
Taiwan 886 02 2377 2222, Thailand 662 278 6777,
Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 523545