

# NI 5102 Specifications

## 15 MHz, 20 MS/s Digitizer

This document lists the specifications of the NI 5102 high-speed digitizer. 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](http://ni.com/manuals) for the most current specifications and product documentation.

## Input Characteristics

Number of input channels .....	2 single-ended, simultaneously sampled
Input impedance .....	1 M $\Omega$ $\pm$ 1% in parallel with 25 pF $\pm$ 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
Max waveform buffer .....	Up to 16 million samples on each channel on NI PCI/PXI-5102 with bus mastering, depends on available host memory 663,000 samples on NI ISA/PCMCIA/USB-5102
Data transfers .....	Programmed I/O supported on all boards; direct-to-memory burst transfers with PCI bus mastering on NI PCI/PXI-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 .....	$\pm 1$ LSB typical, $\pm 1.8$ LSB max
Differential nonlinearity .....	$\pm 0.3$ LSB typical, $\pm 0.5$ LSB max
No missing codes .....	8 bits guaranteed
Offset error after calibration .....	$\pm 1.5$ LSB max
Gain error after calibration.....	$\pm 1\%$ max
DC accuracy .....	$\pm 2.5\%$ of full scale at all gains

## 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  $\pm 1\%$  full-scale range .....

System noise .....

Crosstalk.....

Interchannel skew .....

Aperture jitter .....

## Stability

Recommended warm-up time .....

Offset temperature coefficient .....

Gain temperature coefficient.....

Timebase accuracy .....

# Triggering System

## Analog

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

Level .....256 levels between  $\pm$ full scale  
for CH 0 and CH 1;  
 $\pm 5$  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 $I_{OH} = -10$ $\mu$ A	3.7 V 2.4 V $V_{CC} - 0.1$ V	—
$V_{OL}$	Output LOW voltage	$I_{OL} = 16$ mA $I_{OL} = 10$ $\mu$ A	—	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 ( $\pm 5\%$ ) .....	500 mA typical
NI PXI-5102—5 V DC ( $\pm 5\%$ ) .....	550 mA typical
NI ISA-5102—5 V DC ( $\pm 5\%$ ) .....	300 mA typical
NI PCMCIA-5102—5 V DC ( $\pm 5\%$ ) .....	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 by 17.45 cm (4.2 in. by 6.87 in.)
NI PXI-5102 .....	10.00 cm by 17.00 cm (3.94 in. by 6.69 in.)
NI ISA-5102 .....	10.67 cm by 17.45 cm (4.2 in. by 6.87 in.)
NI USB-5102 .....	14.6 cm by 21.3 cm by 3.8 cm (5.8 in. by 8.4 in. by 1.5 in.)

## Maximum Working Voltage

(Signal voltage plus common-mode voltage)	
Channel to earth .....	5 V, Installation Category I
Channel to channel.....	5 V, Installation Category I

## 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:

- ◆ NI PXI/PCI/USB/ISA-5102:
  - IEC 61010-1, EN 61010-1
  - UL 3111-1, UL 61010B-1
  - CAN/CSA C22.2 No. 1010.1
- ◆ NI PCMCIA-5102:
  - IEC 60950, EN 60950
  - UL 1950, UL 60950
  - CAN/CSA C22.2 No. 60950



**Note** For UL and other safety certifications, refer to the product label or to [ni.com](http://ni.com).

# Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) compliant.

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

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



**Note** For full EMC compliance, you *must* operate this device with shielded cabling. In addition, all covers and filler panels must be installed. See the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit [ni.com/hardref.nsf](http://ni.com/hardref.nsf).

## 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.

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