PXIe-5122 Specifications

2022-07-06

Contents

PXIe-5122 Specifications

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty. Warranted specifications account for measurement uncertainties, temperature drift, and aging. Warranted specifications are ensured by design or verified during production and calibration.

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.
- **Measured** specifications describe the measured performance of a representative model.

Specifications are **Typical** unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- All filter settings
- All impedance selections
- Sample clock set to 100 MS/s

Vertical

Analog Input

Number of channels	Two (simultaneously sampled)
Connectors	BNC

Impedance and Coupling

Input impedance (software-selectable)	50 Ω ± 2.0% 1 MΩ ± 0.75% in parallel with a nominal capacitance of 29 pF
Input coupling (software-selectable)	AC[1] DC GND

Voltage Levels

Range (V_{pk-pk})	Vertical Offset Range	
	50 Ω Input	1 MΩ Input
0.2 V	±0.1 V	
0.4 V	±0.2 V	
1 V	±0.5 V	
2 V	±1 V	
4 V	±2 V	
10 V	—	±5 V
20 V (1 MΩ only)	—	—

Table 1. Full Scale (FS) Input Range and Programmable Vertical Offset

Maximum input overload	
50 Ω	7 V_{rms} with |Peaks| ≤10 V
1 MΩ	|Peaks| ≤42 V

Accuracy

Resolution	14 bits

Input Range (V_{pk-pk})	DC Accuracy
0.2 V and 0.4 V	±(0.65% of input + 1.0 mV)
1 V	±(0.65% of input + 1.2 mV)
2 V	±(0.65% of input + 1.6 mV)
4 V and 10 V	±(0.65% of input + 8.0 mV)
20 V (1 MΩ only)	±(0.65% of input + 13.0 mV)

Table 2. DC Accuracy[2], Warranted

Programmable vertical offset accuracy[3]	±0.4% of offset setting, Warranted

Input Range (V_{pk-pk})	50 Ω and 1 MΩ
0.2 V, 0.4 V, 1 V, and 2 V	±(0.057% of input + 0.006% of FS + 100 µV) per °C
4 V, 10 V	±(0.057% of input + 0.006% of FS + 900 µV) per °C
20 V (1 MΩ only)	

Table 3. DC Drift, nominal

AC amplitude accuracy[3]	
50 Ω	±0.06 dB (±0.7%) at 50 kHz
1 MΩ	±0.09 dB (±1.0%) at 50 kHz

Crosstalk[4]	≤-100 dB at 10 MHz

Bandwidth and Transient Response

Bandwidth (±3 dB)[5]	
0.2 V input range	80 MHz up to 40 °C,[6] warranted
All other input ranges	100 MHz, warranted

Rise/fall time	
0.2 V input range	4.2 ns
All other input ranges	3.5 ns

Bandwidth limit filters[7]	
Noise filter (2-pole Bessel)	20 MHz
Anti-alias filter (6-pole Chebyshev)	40 MHz (-6 dB) 35 MHz (±3 dB), warranted

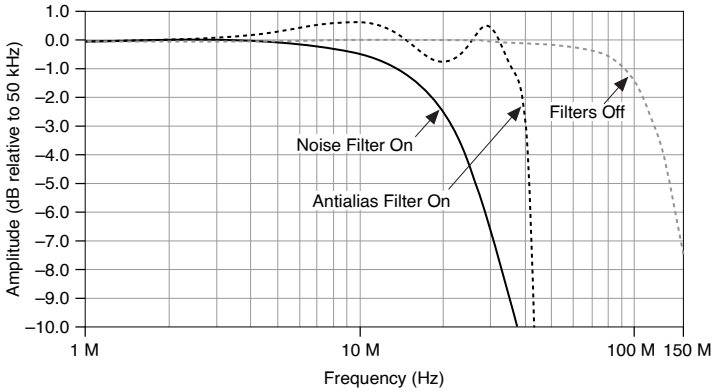
AC coupling cutoff (-3 dB)[8]	12 Hz

Filter Settings	Input Range (V_{pk-pk})	50 Ω and 1 MΩ
Filters off	0.2 V	±0.4 dB (DC to 20 MHz) ±1 dB (20 MHz to 40 MHz)
	All other input ranges	±0.4 dB (DC to 20 MHz)

Filter Settings	Input Range (V_{pk-pk})	50 Ω and 1 MΩ
		±1.0 dB (20 MHz to 50 MHz)
Anti-alias filter on	All ranges	±1.2 dB (DC to 16 MHz) ±1.6 dB (16 MHz to 32 MHz)

Table 4. Passband Flatness[9]

Figure 1. PXIe-5122 Frequency Response, Measured



Spectral Characteristics

Range (V_{pk-pk})	50 Ω	1 MΩ
0.2 V	75 dBc	70 dBc
0.4 V	75 dBc	70 dBc
1 V	75 dBc	70 dBc
2 V	75 dBc	70 dBc
4 V	65 dBc	70 dBc
10 V	65 dBc	60 dBc
20 V	—	60 dBc

Table 5. Spurious-Free Dynamic Range with Harmonics (SFDR)[10]

Range (V_{pk-pk})	50 Ω	1 MΩ
0.2 V	-75 dBc	-68 dBc

Range (V_{pk-pk})	50 Ω	1 MΩ
0.4 V	-75 dBc	-68 dBc
1 V	-75 dBc	-68 dBc
2 V	-73 dBc	-68 dBc
4 V	-63 dBc	-68 dBc
10 V	-63 dBc	-58 dBc
20 V	—	-58 dBc

Table 6. Total Harmonic Distortion (THD)[11]

Intermodulation distortion[12]	-75 dBc

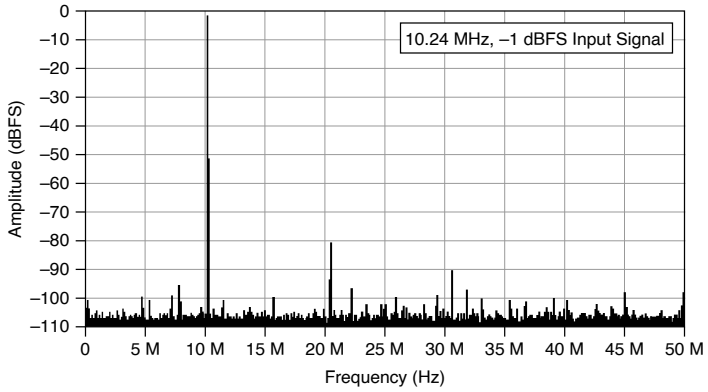
Range (V_{pk-pk})	50 Ω		1 MΩ	
	Filters Off	Anti-alias Filter On	Filters Off	Anti-alias Filter On
0.2 V	60 dB	60 dB	56 dB	60 dB
0.4 V	62 dB	62 dB	61 dB	62 dB
1 V	62 dB	62 dB	62 dB	62 dB
2 V	62 dB	62 dB	62 dB	62 dB
4 V	—	—	61 dB	62 dB

Table 7. Signal-to-Noise Ratio (SNR)[13]

Range (V_{pk-pk})	50 Ω		1 MΩ	
	Filters Off	Anti-alias Filter On	Filters Off	Anti-alias Filter On
0.2 V	60 dB	60 dB	56 dB	59 dB
0.4 V	62 dB	62 dB	60 dB	61 dB
1 V	62 dB	62 dB	61 dB	61 dB
2 V	62 dB	62 dB	61 dB	61 dB
4 V	—	—	60 dB	61 dB

Table 8. Signal to Noise and Distortion (SINAD)[14]

Figure 2. PXIe-5122 Dynamic Performance, 50 Ω, 1 V Range, Measured



Range (V_{pk-pk})	50 Ω	1 MΩ
0.2 V	46 μV_{rms} (0.023% FS)	60 μV_{rms} (0.030% FS)
0.4 V	92 μV_{rms} (0.023% FS)	92 μV_{rms} (0.023% FS)
1 V	230 μV_{rms} (0.023% FS)	230 μV_{rms} (0.023% FS)
2 V	460 μV_{rms} (0.023% FS)	460 μV_{rms} (0.023% FS)
4 V	920 μV_{rms} (0.023% FS)	920 μV_{rms} (0.023% FS)
10 V	2.3 mV_{rms} (0.023% FS)	2.3 mV_{rms} (0.023% FS)
20 V	—	4.6 mV_{rms} (0.023% FS)

Table 9. RMS Noise (Noise Filter On)[15]

Range (V_{pk-pk})	50 Ω	1 MΩ
0.2 V	66 μV_{rms} (0.033% FS)	80 μV_{rms} (0.040% FS)
0.4 V	100 μV_{rms} (0.025% FS)	120 μV_{rms} (0.030% FS)
1 V	250 μV_{rms} (0.025% FS)	300 μV_{rms} (0.030% FS)
2 V	500 μV_{rms} (0.025% FS)	600 μV_{rms} (0.030% FS)
4 V	1 mV_{rms} (0.025% FS)	1.2 mV_{rms} (0.030% FS)
10 V	2.5 mV_{rms} (0.025% FS)	3 mV_{rms} (0.030% FS)
20 V	—	6 mV_{rms} (0.030% FS)

Table 10. RMS Noise (Anti-alias Filter On)[15]

Range (V_{pk-pk})	50 Ω	1 MΩ
0.2 V	66 μV_{rms} (0.033% FS)	110 μV_{rms} (0.055% FS)

Range (V_{pk-pk})	50 Ω	1 MΩ
0.4 V	100 μV_{rms} (0.025% FS)	160 μV_{rms} (0.040% FS)
1 V	250 μV_{rms} (0.025% FS)	300 μV_{rms} (0.030% FS)
2 V	500 μV_{rms} (0.025% FS)	600 μV_{rms} (0.030% FS)
4 V	1 mV_{rms} (0.025% FS)	1.6 mV_{rms} (0.040% FS)
10 V	2.5 mV_{rms} (0.025% FS)	3 mV_{rms} (0.030% FS)
20 V	—	6 mV_{rms} (0.030% FS)

Table 11. RMS Noise (Filters Off)[15]

Figure 3. PXIe-5122 Spectral Noise Density, 0.2 V Input Range, Full Bandwidth, 50 Ω Input Impedance, Nominal

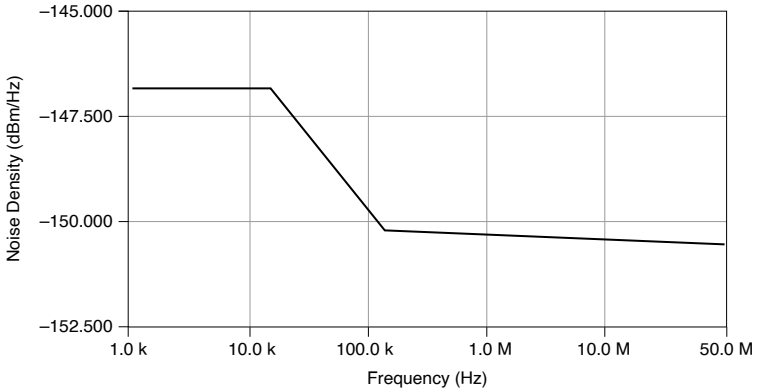
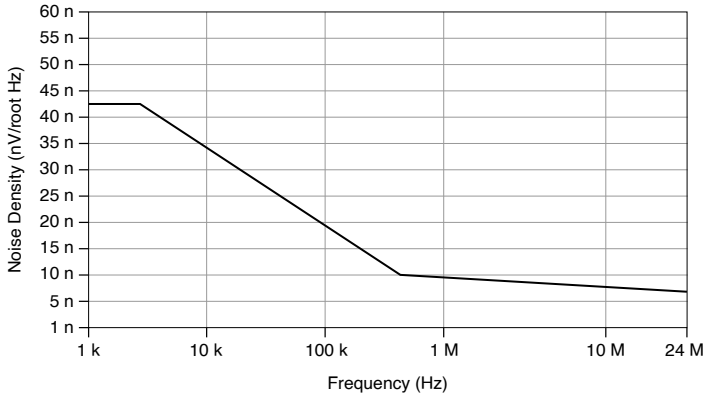


Figure 4. PXIe-5122 Spectral Noise Density, 0.2 V Input Range, Noise Filter Enabled, 1 MΩ Input Impedance, Nominal



Horizontal

Sample Clock

Sources	
Internal	Onboard clock (internal VCXO)[16]
External	CLK IN (front panel SMB connector)
	PXI Star Trigger (backplane connector)

Onboard Clock (Internal VCXO)

Sample rate range	
Real-time sampling (single shot)[17]	1.526 kS/s to 100 MS/s
Random interleaved sampling (RIS)	200 MS/s to 2 GS/s in multiples of 100 MS/s

Phase noise density[18]	<-100 dBc/Hz at 100 Hz <-120 dBc/Hz at 1 kHz <-130 dBc/Hz at 10 kHz
Sample clock jitter[19]	≤1 ps_{rms} (100 Hz to 100 kHz) ≤2 ps_{rms} (100 Hz to 1 MHz)
Timebase frequency	100 MHz
Timebase accuracy	

Not phase-locked to Reference clock	±25 ppm, Warranted
Phase-locked to Reference clock	Equal to the Reference clock accuracy
Sample clock delay range	±1 Sample clock period
Sample clock delay/adjustment resolution	≤10 ps

Related information

- For more information about Sample clock and decimation, refer to the NI High-Speed Digitizers Help.

External Sample Clock

Sources	CLK IN (front panel SMB connector) PXI Star Trigger (backplane connector)
Frequency range[20]	30 MHz to 105 MHz (CLK IN) 30 MHz to 80 MHz (PXI Star Trigger)
Duty cycle tolerance	45% to 55%

Sample Clock Exporting

Destination	Maximum Frequency
CLK OUT (front panel SMB connector)	105 MHz
PXI_Trig <0..6> (backplane connector)[21]	20 MHz
PFI <0..1> (front panel 9-pinmini-circular DIN connector)[21]	25 MHz
RTSI <0..6> [21]	20 MHz

Table 12. Exported Sample Clock Destinations

Phase-Locked Loop (PLL) Reference Clock

Sources	PXI_CLK10 (backplane connector) CLK IN (front panel SMB connector)
Frequency range[22]	5 MHz to 20 MHz in 1 MHz increments
Duty cycle tolerance	45% to 55%
Exported reference clock destinations	CLK OUT (front panel SMB connector) PFI <0..1> (front panel 9-pinmini-circular DIN connector) PXI_Trig <0..7>

CLK IN (Sample Clock and Reference Clock Input)

Connector	SMB jack
Input voltage range Sine wave (V_{pk-pk}) Square wave (V_{pk-pk})	 0.65 V to 2.8 V (0 dBm to 13 dBm) 0.2 V to 2.8 V
Maximum input overload	7 V_{rms} with |Peaks| ≤10 V
Impedance	50 Ω
Coupling	AC

CLK OUT (Sample Clock and Reference Clock Output)

Connector	SMB jack
Output impedance	50 Ω
Logic type	3.3 V CMOS
Maximum drive current	±48 mA

Trigger

Reference (Stop) Trigger

Note Refer to the following sections and the **NI High-Speed Digitizers Help** for more information about what sources are available for each trigger type.

Trigger types	Edge Window Hysteresis Video Digital Immediate Software
Trigger sources	CH 0

	CH 1 TRIG PXI_Trig <0..6> PFI <0..1> Software

Time resolution

Time-to-digital conversion circuit (TDC) on

Onboard clock	100 ps
External clock	N/A

TDC off

Onboard clock	10 ns
External clock	External clock period

Minimum rearm time[23]

TDC on	12 µs
TDC off	3 µs

Holdoff[24]

Onboard clock	Rearm time to 171.79 s
External clock	(**Rearm time**/10 ns) × **External clock period** to (2^{34} - 1) × **External clock period**

Analog Trigger

Trigger types	Edge Window Hysteresis
Sources	CH 0 (front panel BNC connector) CH 1 (front panel BNC connector) TRIG (front panel BNC connector)
Trigger level range	
CH 0, CH 1	100% of FS
TRIG (external trigger)	±5 V
Trigger level resolution	10 bits (1 in 1,024)
Edge trigger sensitivity	
CH 0, CH 1	2.5% FS up to 50 MHz, increasing to 5% FS at 100 MHz, Warranted
TRIG (external trigger, V_{pk-pk})	0.25 V up to 100 MHz, increasing to 1 V at 200 MHz, Warranted
Level accuracy	
CH 0, CH 1	±3.5% FS up to 10 MHz
TRIG (external trigger)	±0.35 V (±3.5% of FS) up to 10 MHz

Trigger jitter	≤80 ps_{rms} [25]
Trigger filters	
Low-frequency (LF) reject	50 kHz
High-frequency (HF) reject	50 kHz

Digital Trigger

Trigger type	Digital
Sources	PXI_Trig <0..6> (backplane connector) PFI <0..1> (front panel SMB connector)

Video Trigger

Trigger type	Video
Sources	CH 0 (front panel BNC connector) CH 1 (front panel BNC connector) TRIG (front panel BNC connector)
Video trigger types	Specific line Any line Specific field
Standards	Negative sync of NTSC, PAL, or SECAM signal

External Trigger

Connector	TRIG (front panel BNC connector)
Impedance	1 MΩ in parallel with 22 pF
Coupling	AC DC
AC-coupling cutoff (-3 dB)	12 Hz
Input voltage range	±5 V
Maximum input overload	|Peaks| ≤42 V

Programmable Function Interface (PFI 0 and PFI 1)

Connector	AUX I/O (9-pin mini-circular DIN)
Direction	Bi-directional

As an input (trigger)

Destinations	Start trigger (acquisition arm) Reference (stop) trigger Arm reference trigger Advance trigger
Input impedance	150 kΩ, nominal

V_{IH}	2.0 V
V_{IL}	0.8 V
Maximum input overload	-0.5 V to 5.5 V
Maximum frequency	25 MHz

As an output (event)

Sources	Ready for Start
	Start trigger (acquisition arm)
	Ready for Reference
	Reference (stop) trigger
	End of Record
	Ready for Advance
	Advance trigger
	Done (end of acquisition)
	Probe Compensation[26]
Output impedance	50 Ω
Logic type	3.3 V CMOS
Maximum drive current	±12 mA
Maximum frequency	25 MHz

Waveform

Memory per Channel	Samples per Channel	Maximum Number of Records in Onboard Memory
8 MB (standard option)	4 MS	16,384
64 MB	32 MS	100,000[]
256 MB	128 MS	100,000[]

Table 13. Onboard Memory Size

Minimum record length	1 sample
Number of pretrigger samples	Zero up to full record length[28]
Number of posttrigger samples	Zero up to full record length[28]
Allocated onboard memory per record	(**Record Length** × 2 bytes/S) + 480 bytes, rounded up to next multiple of 128 bytes or 512 bytes, whichever is greater

Related information

- For more information about fetching records while acquiring data, refer to the NI High-Speed Digitizers Help, available at ni.com/manuals.

Calibration

External Calibration

External calibration calibrates the VCXO and the voltage reference. All calibration constants are stored in nonvolatile memory.

Self-Calibration

Self-calibration is done on software command. The calibration corrects for gain, offset, frequency response, triggering, and timing adjustment errors for all input ranges.

Calibration Specifications

Interval for external calibration	2 years
Warm-up time[29]	15 minutes

Software

Driver Software

Driver support for this device was first available in NI-SCOPE3.3.1.

NI-SCOPE is an IVI-compliant driver that allows you to configure, control, and calibrate the PXIe-5122. NI-SCOPE provides application programming interfaces for many development environments.

Application Software

NI-SCOPE provides programming interfaces, documentation, and examples for the following application development environments:

- LabVIEW
- LabWindows™/CVI™
- Measurement Studio
- Microsoft Visual C/C++
- .NET (C# and VB.NET)

Interactive Soft Front Panel and Configuration

When you install NI-SCOPE on a 64-bit system, you can monitor, control, and record measurements from the PXIe-5122 using InstrumentStudio.

InstrumentStudio is a software-based front panel application that allows you to perform interactive measurements on several different device types in a single program.

Note InstrumentStudio is supported only on 64-bit systems. If you are using a 32-bit system, use the NI-SCOPE–specific soft front panel instead of InstrumentStudio.

Interactive control of the PXIe-5122 was first available via InstrumentStudio in NI-SCOPE2018 and via the NI-SCOPE SFP in NI-SCOPE2.7. InstrumentStudio and the NI-SCOPE SFP are included on the NI-SCOPE media.

NI Measurement & Automation Explorer (MAX) also provides interactive configuration and test tools for the PXIe-5122. MAX is included on the driver media.

TClk Specifications

You can use the NI TClk synchronization method and the NI-TClk driver to align the Sample clocks on any number of supported devices, in one or more chassis. For more information about TClk synchronization, refer to the **NI-TClk Synchronization Help**, which is located within the **NI High-Speed Digitizers Help**. For other configurations, including multichassis systems, contact NI Technical Support at ni.com/support.

Intermodule SMC Synchronization Using NI-TClk for Identical Modules

Specifications are valid under the following conditions:

- PXI-5122 modules installed in one NI PXI-1042 chassis, or PXIe-5122 modules installed in one PXI Express chassis.
- All parameters set to identical values for each SMC-based module.
- Sample clock set to 100 MS/s and all filters disabled.

Note Although you can use NI-TClk to synchronize non-identical modules, these specifications apply only to synchronizing identical modules.

Skew[30]	500 ps

Average skew after manual adjustment[31]	<10 ps
Sample clock delay/adjustment resolution	≤10 ps

Power

Current draw	
+3.3 V DC	1.6 A, maximum
+12 V DC	2.0 A, typical 2.32 A, maximum
Total power	29.28 W, typical 33.12 W, maximum

Dimensions and Weight

Dimensions	3U, one-slot, PXI Express module 21.3 cm × 2.0 cm × 13.0 cm (8.4 in. × 0.8 in. × 5.1 in.)
Weight	453 g (16.0 oz)

Environment

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)

Pollution Degree	2

Indoor use only.

Operating Environment

Ambient temperature range	0 °C to 40 °C
Relative humidity range	10% to 90%, noncondensing

Storage Environment

Ambient temperature range	-40 °C to 71 °C
Relative humidity range	5% to 95%, noncondensing

Shock and Vibration

Operating shock	30 g peak, half-sine, 11 ms pulse
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms}

Compliance and Certifications

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.

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] AC coupling available on 1 MΩ input only.

[2] Programmable vertical offset = 0 V. Within ±5 °C of self-calibration temperature.

[3] Within ±5 °C of self-calibration temperature.

[4] CH 0 to/from CH 1 and External Trigger to CH 0 or CH 1.

[5] Filters off.

[6] 78 MHz above 40 °C.

[7] Only one filter can be enabled at any given time. The anti-alias filter is enabled by default.

[8] AC coupling available on 1 MΩ input only.

[9] Referenced to 50 kHz.

[10] 10 MHz, -1 dBFS input signal. Includes the 2nd through the 5th harmonics. Measured from DC to 50 MHz.

[11] 10 MHz, -1 dBFS input signal. Includes the 2nd through the 5th harmonics.

[12] 0.2 V to 2.0 V input range. 50 Ω input impedance. Two tones at 10.2 MHz and 11.2 MHz. Each tone is -7 dBFS.

[13] 10 MHz, -1 dBFS input signal. Excludes harmonics. Measured from DC to 50 MHz.

[14] 10 MHz, -1 dBFS input signal. Includes harmonics. Measured from DC to 50 MHz.

[15] 50 Ω terminator connected to input.

[16] Internal Sample clock is locked to the Reference clock or derived from the onboard VCXO.

[17] Divide by **n** decimation used for all rates less than 100 MS/s.

[18] 10 MHz input signal.

[19] Includes the effects of the converter aperture uncertainty and the clock circuitry jitter. Excludes trigger jitter.

[20] Divide by **n** decimation available, where 1 ≤ **n** ≤ 65,535.

[21] Decimated Sample clock only.

[22] Default of 10 MHz. The PLL Reference clock frequency must be accurate to ±50 ppm.

[23] Holdoff set to 0. Onboard Sample clock at maximum rate.

[24] TDC is off when using external Sample clock.

[25] Within ±5 °C of self-calibration temperature.

[26] 1 kHz, 50% duty cycle square wave, PFI 1 only.

[27] It is possible to exceed this number if you fetch records while acquiring data.

[28] Single-record mode and multiple-record mode.

[29] Warm-up time begins after the NI-SCOPE driver is loaded. Unless manually disabled, the NI-SCOPE driver automatically loads with the operating system and enables the module.

[30] Caused by clock and analog path delay differences. No manual adjustment performed.

[31] For information about manual adjustment, refer to the **Synchronization Repeatability Optimization** topic in the **NI-TClk Synchronization Help** available at ni.com/manuals. For additional help with the adjustment process, contact NI Technical Support at ni.com/support.