

NI PXI-5105 Specifications

12-Bit 60 MS/s Digitizer

Unless otherwise noted, the following conditions were used for each specification:

- All filter settings
- All impedance selections
- Sample clock set to 60 MS/s

Typical values are representative of an average unit operating at room temperature. Specifications are subject to change without notice. For the most recent NI 5105 specifications, visit ni.com/manuals.

To access the NI 5105 documentation, including the *NI High-Speed Digitizers Getting Started Guide*, go to **Start»Programs»National Instruments»NI-SCOPE»Documentation**.



Hot Surface If the NI 5105 has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 5105 to cool before removing it from the PXI chassis or PC.

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Vertical

Analog Input (Channels 0–7)

| Specification | Value | | Comments |
|-------------------------------|---|------------------------------------|---|
| Number of Channels | Eight (simultaneously sampled) | | — |
| Connectors | SMB | | — |
| Impedance and Coupling | | | |
| Input Impedance | 50 Ω \pm 2% 1 M Ω \pm 1% in parallel with a typical capacitance of 50 pF | | Software selectable. |
| Input Coupling | AC, DC | | AC coupling available on 1 M Ω only. |
| Voltage Levels | | | |
| Full Scale (FS) Input Range | 50 Ω Range (V_{pk-pk}) | 1 M Ω Range (V_{pk-pk}) | — |
| | 0.05 | 0.05 | — |
| | 0.2 | 0.2 | — |
| | 1 | 1 | — |
| | 6 | 6 | — |
| | — | 30 | — |
| Maximum Input Overload | 50 Ω | 1 M Ω | — |
| | 7 V_{rms} with $ Peaks \leq 10$ V | $ Peaks \leq 42$ V | |

| Specification | Value | | | | Comments |
|--------------------------|---|-----------------------|---|--------------------------|--|
| Accuracy | | | | | |
| Resolution | 12 bits | | | | — |
| DC Accuracy | 50 Ω | | 1 MΩ | | Within ±5 °C of self-calibration temperature. |
| | All ranges: ±(1% of Input + 0.25% of FS + 600 μV) | | 50 mV range: ±(1% of Input + 0.25% of FS + 600 μV) | | |
| | | | 200 mV, 1 V, and 6 V ranges: ±(0.65% of Input + 0.25% of FS + 600 μV) | | |
| | | | 30 V range: ±(0.75% of Input + 0.25% of FS + 600 μV) | | |
| DC Drift | ±(0.05% of Input + 0.02% of FS + 20 μV) per °C | | | | — |
| AC Amplitude Accuracy | 50 Ω | | 1 MΩ | | Within ±5 °C of self-calibration temperature. |
| | Range V _{pk-pk} | At 50 kHz, typical | Range V _{pk-pk} | At 50 kHz, guaranteed | |
| | 0.05 | ± 0.1 dB (± 1.2%) | 0.05 | ± 0.2 dB (± 2.3%) | |
| | 0.2 | ± 0.1 dB (± 1.2%) | 0.2 | ± 0.13 dB (± 1.5%) | |
| | 1 | ± 0.1 dB (± 1.2%) | 1 | ± 0.13 dB (± 1.5%) | |
| | 6 | ± 0.1 dB (± 1.2%) | 6 | ± 0.4 dB (± 4.7%) | |
| | — | | 30 | ± 0.4 dB (± 4.7%) | |
| Crosstalk, Typical | 50 Ω | | 1 MΩ | | Channel to nearest channel. |
| | All ranges: ≤ -80 dB at 1 MHz | | 50 mV range: ≤ -75 dB at 1 MHz All other ranges: ≤ -80 dB at 1 MHz | | Channels in same configuration. |

| Specification | Value | | | Comments |
|--|--------------------------|-------------|--------------|--|
| Bandwidth and Transient Response | | | | |
| Bandwidth (-3 dB), Typical | Range (V_{pk-pk}) | 50 Ω | 1 M Ω | — |
| | 0.05 | 55 MHz | 35 MHz | |
| | All other ranges | 60 MHz | 60 MHz | |
| Bandwidth Limit Filter | 24 MHz Antialias Filter | | | — |
| AC Coupling* Cutoff (-3 dB), Typical | 12 Hz | | | * AC coupling available on 1 M Ω only |
| Passband Flatness | Refer to Figure 1 | | | — |

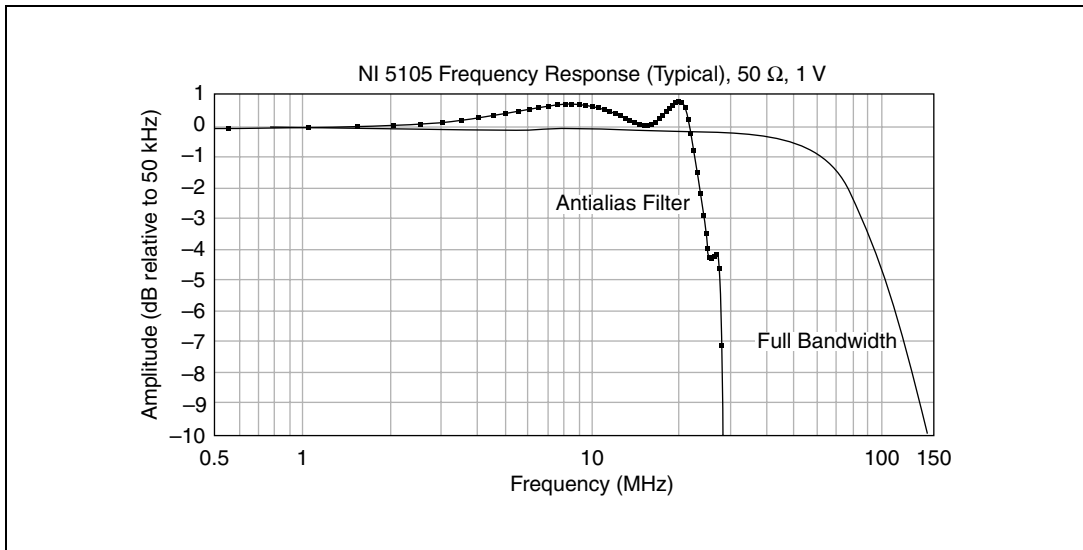


Figure 1. NI 5105 Frequency Response (Typical)

| Specification | Value | | | Comments |
|--|-----------------------|-------------|--------------|--|
| Spectral Characteristics | | | | |
| Spurious Free Dynamic Range with Harmonics (SFDR), Typical | Range V_{pk-pk} | 50 Ω | 1 M Ω | 5 MHz, -1 dBFS input signal. Includes the 2 nd through the 4 th harmonics. 24 MHz filter on. |
| | 0.2 | 72 dBc | 70 dBc | |
| | 1 | 72 dBc | 65 dBc | |
| | 6 | 72 dBc | 65 dBc | |
| Total Harmonic Distortion (THD), Typical | Range V_{pk-pk} | 50 Ω | 1 M Ω | 5 MHz, -1 dBFS input signal. Includes the 2 nd through the 4 th harmonics. 24 MHz filter on. |
| | 0.05 | -75 dBc | -72 dBc | |
| | 0.2 | -75 dBc | -75 dBc | |
| | 1 | -75 dBc | -65 dBc | |
| Signal to Noise and Distortion (SINAD), Typical | Range (V_{pk-pk}) | 50 Ω | 1 M Ω | 5 MHz, -1 dBFS input signal. Includes the 2 nd through the 4 th harmonics. 24 MHz filter on. |
| | 0.05 | 59 dB | 50 dB | |
| | 0.2 | 62 dB | 59 dB | |
| | 1 | 62 dB | 61 dB | |
| | 6 | 62 dB | 59 dB | |

| Specification | Value | | | | Comments | |
|----------------------------------|--------------------------------|----------------------|------------------------|-----------------------|---------------------------|-------------------------------------|
| RMS Noise | Range (V _{pk-pk}) | 50 Ω | | 1 MΩ | | 50 Ω terminator connected to input. |
| | | Full BW | 24 MHz Filter On | Full BW | 24 MHz Filter On | |
| | 0.05 | 0.06% FS (30 μV) | 0.038% FS (19 μV) | 0.16% FS (80 μV) | 0.12% FS (60 μV) | |
| | 0.2 | 0.035% FS (70 μV) | 0.028% FS (56 μV) | 0.055% FS (110 μV) | 0.036% FS (72 μV) | |
| | 1 | 0.03% FS (300 μV) | 0.029% FS (290 μV) | 0.03% FS (300 μV) | 0.03% FS (300 μV) | |
| | 6 | 0.03% FS (1.8 mV) | 0.028% FS (1.68 mV) | 0.055% FS (3.3 mV) | 0.036% FS (2.16 mV) | |
| | 30 | — | — | 0.03% FS (9 mV) | 0.03% FS (9 mV) | |
| Skew | | | | | | |
| Channel to Channel Skew, Typical | 24 MHz Filter On | | 24 MHz Filter Off | | 10 MHz sine input signal. | |
| | ≤ 600 ps | | ≤ 500 ps | | | |

Horizontal

Sample Clock

| Specification | Value | | Comments |
|--------------------------------------|---|---------------------------------------|--|
| Sources | Internal: Onboard Clock (internal VCXO)* External: PFI 1, PXI Star | | * Internal Sample Clock is locked to the Reference Clock or derived from the onboard VCXO. |
| Onboard Clock (Internal VCXO) | | | |
| Sample Rate Range | Real-Time Sampling (Single Shot) | | * Divide by n decimation used for all rates less than 60 MS/s. For more information about Sample Clock and decimation, refer to the <i>NI High-Speed Digitizers Help</i> . |
| | 60 MS/s* | | |
| Timebase Frequency | 60 MHz | | — |
| Timebase Accuracy | Not Phase-Locked to Reference Clock | Phase-Locked to Reference Clock | — |
| | ± 25 ppm | Equal to the Reference Clock accuracy | |
| Sample Clock Delay Range | ± 1 Sample Clock period | | — |
| Sample Clock Delay Resolution | < 10 ps | | — |

| Specification | Value | | Comments |
|------------------------------------|-----------------|-------------------|---|
| External Sample Clock | | | |
| Sources | PFI 1, PXI Star | | — |
| Frequency Range | 8 MHz to 65 MHz | | Divide by n decimation available where $1 \leq n \leq 65,535$. For more information about Sample Clock and decimation, refer to the <i>NI High-Speed Digitizers Help</i> . |
| Duty Cycle Tolerance | 45% to 55% | | — |
| Sample Clock Exporting | | | |
| Exported Sample Clock Destinations | Destination | Maximum Frequency | Cannot export decimated Sample Clock. |
| | PFI 1 | 65 MHz | |

Phase-Locked Loop (PLL) Reference Clock

| Specification | Value | Comments |
|---------------------------------------|---|----------|
| Sources | PXI_CLK10 (PXI backplane connector) PFI 1 | — |
| Frequency Range | 1 MHz to 20 MHz in 1 MHz increments. Default of 10 MHz. The PLL Reference Clock frequency must be accurate to ± 50 ppm. | — |
| Duty Cycle Tolerance | 45% to 55% | — |
| Exported Reference Clock Destinations | PFI 1 | — |

Trigger

Reference (Stop) Trigger

| Specification | Value | | Comments |
|--|--|---|---|
| Trigger Types and Sources | Types | Sources | Refer to the following sections and <i>NI High-Speed Digitizers Help</i> for more information about what sources are available for each trigger type. |
| | Edge, Window, Hysteresis, Digital, Immediate, and Software | CH 0–CH 7, PFI 1 PXI_Trig <0..6>, PXI Star Trigger, and Software | |
| Time Resolution | Sample Clock Timebase Period | | — |
| Rearm Time | 144 × Sample Clock Period | | — |
| Holdoff | From Rearm time up to $[(2^{32} - 1) \times \text{Sample Clock Timebase Period}]$ | | — |
| Analog Trigger (Edge, Window, and Hysteresis Trigger Types) | | | |
| Sources | CH 0–CH 7 (front panel SMB connectors) | | — |
| Trigger Level Range | 100% FS | | — |
| Edge Trigger Sensitivity | 2% FS | | — |
| Trigger Jitter | Sample Clock Timebase Period | | — |
| Digital Trigger (Digital Trigger Type) | | | |
| Sources | PXI_Trig <0..6> (backplane connector) PFI 1 (front panel SMB connector) PXI Star Trigger (backplane connector) | | — |

PFI 1 (Programmable Function Interface, Front Panel Connector)

| Specification | Value | Comments |
|---|---|----------|
| Connector | SMB | — |
| Direction | Bidirectional | — |
| Coupling | AC, DC | — |
| As Sample Clock, Reference Clock | | |
| Input Voltage Range | Sine Wave: 0.65 V _{pk-pk} to 2.8 V _{pk-pk} (0 dBm to 13 dBm) Square Wave: 0.2 V _{pk-pk} to 2.8 V _{pk-pk} | — |
| Maximum Input Overload | 7 V _{rms} with Peaks ≤ 10 V | — |
| Input Impedance | 50 Ω | — |
| Coupling | AC | — |
| As an Input (Digital Trigger) | | |
| Destinations | Start Trigger (Acquisition Arm) Reference (Stop) Trigger Arm Reference Advance Trigger | — |
| Input Impedance | 150 kΩ | — |
| V _{IH} | 2.0 V | — |
| V _{IL} | 0.8 V | — |
| Maximum Input Overload | –0.5 V to 5.5 V | — |
| Maximum Frequency | 65 MHz | — |

| Specification | Value | Comments |
|-----------------------|---|----------|
| As an Output | | |
| Sources | Start Trigger (Acquisition Arm) Reference (Stop) Trigger End of Record Done (End of Acquisition) Sample Clock Timebase Reference Clock | — |
| Output Impedance | 50 Ω | — |
| Logic Type | 3.3 V CMOS | — |
| Maximum Drive Current | ± 24 mA | — |

TClk Specifications

National Instruments TClk synchronization method and the NI-TClk driver are used to align the sample clocks on any number of SMC-based modules in a chassis. For more information about TClk synchronization, refer to the *NI-TClk Synchronization Help*, which is located within the *NI High-Speed Digitizers Help*.

- Specifications are valid for any number of modules installed in one NI PXI-1042 chassis.
- All parameters set to identical values for each SMC-based module.
- Sample Clock set to 60 MS/s and all filters are disabled.
- For other configurations, including multichassis systems, contact NI Technical Support at ni.com/support.



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

| Specification | Value | Comments |
|--|---------|--|
| Intermodule SMC Synchronization Using NI-TClk for Identical Modules (Typical) | | |
| Skew | 500 ps | Caused by clock and analog path delay differences. No manual adjustment performed. |
| Skew After Manual Adjustment | < 10 ps | For information about manual adjustment, refer to the <i>Synchronization Repeatability Optimization</i> topic in the <i>NI-TClk Synchronization Help</i> . For additional help with the adjustment process, contact NI Technical Support at ni.com/support . |
| Sample Clock Adjustment Resolution | < 10 ps | — |

Waveform Specifications

| Specification | Value | Comments |
|-------------------------------------|---|--|
| Onboard Memory Size | 16 MB Standard | — |
| | 128 MB Option | |
| | 512 MB Option | |
| Minimum Record Length | 1 Sample | — |
| Number of Pretrigger Samples | Zero up to full record length | Single-record mode and multiple-record mode. |
| Number of Posttrigger Samples | Zero up to full record length | Single-record mode and multiple-record mode. |
| Allocated Onboard Memory per Record | $[(\text{Record length}^* \times 2^\dagger \times \text{number of enabled channels}) + 480^\ddagger]$ rounded up to nearest 128 bytes Note: The maximum number of records is 100,000. | * samples † bytes/sample ‡ bytes |

Calibration

| Specification | Value | Comments |
|--|---|----------|
| Self-Calibration | Self-calibration is done on software command. The calibration corrects for gain, offset, triggering, and timing adjustment errors for all input ranges. | — |
| External Calibration (Factory Calibration) | The external calibration calibrates the VCXO and the voltage reference. Appropriate constants are stored in nonvolatile memory. | — |
| Interval for External Calibration | 2 years | — |
| Warm-Up Time | 15 minutes | — |

Power

| Specification | Typical Value | Comments |
|---------------|---------------|----------|
| +3.3 VDC | 1.5 A | — |
| +5 VDC | 1.7 A | |
| +12 VDC | .20 A | |
| –12 VDC | .025 A | |
| Total Power | 16.15 W | |

Software

| Specification | Value | Comments |
|--|---|----------|
| Driver Software | NI-SCOPE 3.1 or later. NI-SCOPE is an IVI-compliant driver that allows you to configure, control, and calibrate the NI 5105. 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: <ul style="list-style-type: none">• LabVIEW• LabWindows™/CVI™• Measurement Studio• Microsoft Visual C/C++• Microsoft Visual Basic | — |
| Interactive Soft Front Panel and Configuration | The Scope Soft Front Panel 2.5 or later supports interactive control of the NI 5105. The Scope Soft Front Panel is included on the NI-SCOPE CD. National Instruments Measurement & Automation Explorer (MAX) also provides interactive configuration and test tools for the NI 5105. MAX is included on the NI-SCOPE CD. | — |

Environment



Note To ensure that the NI PXI-5105 cools effectively, follow the guidelines in the *Maintain Forced Air Cooling Note to Users* included in the NI PXI-5105 kit. The NI PXI-5105 is intended for indoor use only.

| Specification | Value | Comments |
|-----------------------------|--|----------|
| Operating Temperature | 0 °C to +55 °C in all NI PXI chassis except the following: 0 °C to +45 °C when installed in an NI PXI-1000/B or PXI-101x chassis. Meets IEC-60068-2-1 and IEC-60068-2-2. | — |
| Storage Temperature | –40 °C to +71 °C. Meets IEC-60068-2-1 and IEC-60068-2-2. | — |
| Operating Relative Humidity | 10% to 90%, noncondensing. Meets IEC-60068-2-56. | — |
| Storage Relative Humidity | 5% to 95%, noncondensing. Meets IEC-60068-2-56. | — |
| Operating Shock | 30 g, half-sine, 11 ms pulse. Meets IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F. | — |
| Storage Shock | 50 g, half-sine, 11 ms pulse. Meets IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F. | — |
| Operating Vibration | 5 Hz to 500 Hz, 0.31 g _{rms} . Meets IEC-60068-2-64. | — |
| Storage Vibration | 5 Hz to 500 Hz, 2.46 g _{rms} . Meets IEC-60068-2-64. Test profile exceeds requirements of MIL-PRF-28800F, Class B. | — |
| Altitude | 2,000 m maximum (at 25 °C ambient temperature) | — |
| Pollution Degree | 2 | — |

Safety, Electromagnetic Compatibility, and CE Compliance

| Specification | Value | Comments |
|---|---|----------|
| Safety | <p>The NI 5105 meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:</p> <ul style="list-style-type: none"> • IEC 61010-1, EN 61010-1 • UL 61010-1, CAN/CSA-C22.2 No. 61010-1 | — |
| <p>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.</p> | | |
| Emissions | EN 55011 Class A at 10 m FCC Part 15A above 1 GHz | — |
| Immunity | EN 61326 EMC requirements; Minimum Immunity | — |
| EMC/EMI | CE, C-Tick, and FCC Part 15 (Class A) Compliant Note: For EMC compliance, operate this device with shielded cabling. | — |
| <p>This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:</p> | | |
| Low-Voltage Directive (safety) | 73/23/EEC | — |
| Electromagnetic Compatibility Directive (EMC) | 89/336/EEC | — |
| <p>For EMC compliance, operate this device with shielded cabling. 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.</p> | | |
| Waste Electrical and Electronic Equipment (WEEE) | <p>EU Customers: At the end of their life cycle, all products <i>must</i> 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.</p> | |

Physical

| Specification | Value | Comments |
|-------------------------------|--|----------------|
| Dimensions | 3U, One slot, PXI/cPCI Module 21.6 × 2.0 × 13.0 cm (8.5 × 0.8 × 5.1 in.) | — |
| Weight | 474 g (16.7 oz) | — |
| Front Panel Connectors | | |
| Label | Function | Connector Type |
| CH 0–CH 7 | Analog input | SMB jack |
| PFI 1 | Trigger input/output, external clock in, reference clock input/output, and timebase out | SMB jack |

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.

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Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24,
Germany 49 0 89 741 31 30, India 91 80 41190000,
Israel 972 0 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 7 095 783 68 51,
Singapore 1800 226 5886, Slovenia 386 3 425 4200,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
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