SPECIFICATIONS

USB-5133
50 MHz, 100 MS/s, 2-Channel, 8-Bit USB Oscilloscope Device

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Definitions

**Caution**  The protection provided by the NI 5133 can be impaired if it is used in a manner not described in this document.

*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.

The following characteristic specifications 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 in this document are *Typical* unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted:

- Full bandwidth
- The Sample Clock is set to full rate.
- The module is warmed up for 10 minutes at ambient temperature.
- Self-calibration is completed after warm-up period.
- Calibration cycle is maintained.

Vertical

**Analog Input**

<table>
<thead>
<tr>
<th>Number of channels</th>
<th>2, simultaneously sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>BNC</td>
</tr>
</tbody>
</table>
Impedance and Coupling

Input impedance
1 MΩ ±1% in parallel with a nominal capacitance of 19 pF

Input coupling
AC, DC, GND

Voltage Levels

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

<table>
<thead>
<tr>
<th>Range (V_{pk-pk})</th>
<th>Vertical Offset Range (V)^1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.04</td>
<td>±0.4</td>
</tr>
<tr>
<td>0.1</td>
<td>±0.4</td>
</tr>
<tr>
<td>0.2</td>
<td>±0.4</td>
</tr>
<tr>
<td>0.4</td>
<td>±0.4</td>
</tr>
<tr>
<td>1.0</td>
<td>±4.0</td>
</tr>
<tr>
<td>2.0</td>
<td>±4.0</td>
</tr>
<tr>
<td>4.0</td>
<td>±4.0</td>
</tr>
<tr>
<td>10</td>
<td>±25.0</td>
</tr>
<tr>
<td>20</td>
<td>±20.0</td>
</tr>
<tr>
<td>40</td>
<td>±10.0</td>
</tr>
</tbody>
</table>

Maximum input overload | |Peaks| ≤ 30 V

Accuracy

Resolution
8 bits

Accuracy, warranted\(^2\) ±(2% of input + 1% FS + 300 μV)

DC drift, nominal ±(0.033% of input + 0.06% of FS + 40 μV) per °C

AC coupling cutoff (-3 dB) 12 Hz

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^1 Programmable Vertical Offset Accuracy: ±2 mV on 40 mV range, ±2.5% on all other ranges, warranted

^2 Within 5 °C of self-calibration temperature.
Bandwidth and Transient Response

Bandwidth\(^3, 4\) (-3 dB), warranted

<table>
<thead>
<tr>
<th>Range</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>All ranges except 0.04 V(_{pk-pk}) range</td>
<td>50 MHz</td>
</tr>
<tr>
<td>0.04 V(_{pk-pk}) range</td>
<td>35 MHz</td>
</tr>
</tbody>
</table>

Bandwidth limit filter          20 MHz noise filter

![Figure 1. Frequency Response, Measured](image)

A. Frequency response at full bandwidth, all ranges except 40 mV\(_{pk-pk}\) range, measured
B. Frequency response at full bandwidth, 40 mV\(_{pk-pk}\) range, measured
C. Frequency response with 20 MHz noise filter, all ranges, measured

Spectral Characteristics

RMS noise

<table>
<thead>
<tr>
<th>Range</th>
<th>RMS Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>All ranges except 0.04 V(_{pk-pk}) range</td>
<td>0.35% FS</td>
</tr>
<tr>
<td>0.04 V(_{pk-pk}) range</td>
<td>0.55% FS</td>
</tr>
</tbody>
</table>

\(^3\) Filter off

\(^4\) Normalized to 50 kHz
**Horizontal**

**Sample Clock**

**Onboard Clock**

| Sample rate range, real-time sampling (single shot) | 1.526 kS/s to 100 MS/s |
| Timebase frequency | 100 MHz |
| Timebase accuracy | ±50 ppm |

**Related Information**

*Fore more information about Sample Clock and decimation, refer to the NI High-Speed Digitizers Help.*

---

5 Divide by \( n \) decimation used for all rates less than maximum speed.
External Sample Clock

<table>
<thead>
<tr>
<th>Sources</th>
<th>PFI 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>1 MHz to 100 MHz</td>
</tr>
<tr>
<td>Duty cycle tolerance</td>
<td>45% to 55%</td>
</tr>
</tbody>
</table>

Related Information

PFI 1 (Programmable Function Interface) on page 7

Trigger

Reference (Stop) Trigger

Table 2. Trigger Types and Sources

<table>
<thead>
<tr>
<th>Types</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge, window, hysteresis</td>
<td>CH 0, CH 1</td>
</tr>
<tr>
<td>Digital</td>
<td>PFI 1</td>
</tr>
<tr>
<td>Immediate, software</td>
<td>—</td>
</tr>
</tbody>
</table>

Analog Trigger (Edge, Window, and Hysteresis Trigger Types)

<table>
<thead>
<tr>
<th>Sources</th>
<th>CH 0 (front panel BNC connector), CH 1 (front panel BNC connector)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger level resolution</td>
<td>8 bits</td>
</tr>
<tr>
<td>Trigger level range</td>
<td>Same as input signal</td>
</tr>
</tbody>
</table>

Digital Trigger (Digital Trigger Type)

<table>
<thead>
<tr>
<th>Sources</th>
<th>PFI 1</th>
</tr>
</thead>
</table>

---

6 Input must meet 3.3 V CMOS Logic requirements.
7 If a digital trigger is being supplied through the PF1 line, an external clock cannot be used.
Start Trigger

Table 3. Trigger Types and Sources

<table>
<thead>
<tr>
<th>Types</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital</td>
<td>PFI 1</td>
</tr>
<tr>
<td>Immediate and Software</td>
<td>—</td>
</tr>
</tbody>
</table>

Digital Trigger (Digital Trigger Type)

Sources

PFI 1

PFI 1 (Programmable Function Interface)

Connector
BNC

Direction
Bidirectional

As an Input (Trigger)

Destinations
Start Trigger, Reference Trigger, External Sample Clock

Input impedance
1 MΩ, nominal

$V_{IH}$
2.4 V

$V_{IL}$
400 mV

Maximum input overload
-0.5 V to 3.5 V

Minimum pulse width
20 ns

As an Output (Event)

Sources
Ready for Start, Ready for Reference, End of Acquisition (Done)

Output impedance
50 Ω

Logic type
3.3 V CMOS

Maximum drive current
20 mA

Minimum pulse width
100 ns

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8 If a digital trigger is being supplied through the PFI line, an external clock cannot be used.
Waveform Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onboard memory size</td>
<td>4 MB per channel option or 32 MB per channel option</td>
</tr>
<tr>
<td>Minimum record length</td>
<td>1 Sample</td>
</tr>
<tr>
<td>Number of pretrigger samples</td>
<td>4 MB – posttrigger samples or 32 MB – posttrigger samples</td>
</tr>
<tr>
<td>Number of posttrigger samples</td>
<td>4 MB – pretrigger samples or 32 MB – pretrigger samples</td>
</tr>
</tbody>
</table>

Calibration

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-calibration</td>
<td>Self-calibration is done on software command. The calibration corrects for offset.</td>
</tr>
<tr>
<td>External calibration (factory calibration)</td>
<td>The external calibration calibrates the gain, the 1 MΩ attenuator, and the programmable vertical offset accuracy. Appropriate constants are stored in nonvolatile memory.</td>
</tr>
<tr>
<td>Interval for external calibration</td>
<td>2 years</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

Power

<table>
<thead>
<tr>
<th>Power</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5 VDC</td>
<td>230 mA</td>
</tr>
<tr>
<td>Total power</td>
<td>1.15 W</td>
</tr>
</tbody>
</table>

Software

Driver Software

Driver support for this device was first available in NI-SCOPE 14.1.

NI-SCOPE is an IVI-compliant driver that allows you to configure, control, and calibrate the NI 5133. 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)

Related Information

For NI-SCOPE .NET support, visit ni.com.

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 NI 5133 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 NI 5133 was first available via InstrumentStudio in NI-SCOPE 18.1 and via the NI-SCOPE SFP in NI-SCOPE 3.5. 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 NI 5133. MAX is included on the driver media.

Physical

Front Panel

Figure 3. NI 5133 Front Panel

NI USB-5133 50MHz, 100 MS/s Oscilloscope
<table>
<thead>
<tr>
<th>Connector</th>
<th>Function</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 0</td>
<td>Analog input</td>
<td>BNC female</td>
</tr>
<tr>
<td>CH 1</td>
<td>Analog input</td>
<td>BNC female</td>
</tr>
<tr>
<td>PFI 1</td>
<td>Digital input/output/clk in</td>
<td>BNC female</td>
</tr>
</tbody>
</table>

**Back Panel**

**Figure 4. NI 5133 Back Panel**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Function</th>
<th>Indicator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicates that the device has power and has been recognized by the system</td>
<td>LED</td>
</tr>
</tbody>
</table>

**Cleaning Statement**

**Notice**  Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

**Notice**  If the NI 5133 is uninstalled, clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

**Dimensions and Weight**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>18.49 × 3.38 × 10.29 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(7.279 × 1.314 × 4.053 in.)</td>
</tr>
</tbody>
</table>

| Weight     | 244 g (8.6 oz) |

**Environment**

<table>
<thead>
<tr>
<th>Maximum altitude</th>
<th>2,000 m (at 25 °C ambient temperature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution Degree</td>
<td>2</td>
</tr>
</tbody>
</table>
Indoor use only.

Operating Environment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range</td>
<td>0 °C to 45 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)</td>
</tr>
<tr>
<td>Relative humidity range</td>
<td>10% to 90%, noncondensing (Tested in accordance with IEC 60068-2-56.)</td>
</tr>
</tbody>
</table>

Storage Environment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range</td>
<td>-20 °C to 70 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.)</td>
</tr>
<tr>
<td>Relative humidity range</td>
<td>10% to 90%, noncondensing (Tested in accordance with IEC 60068-2-56.)</td>
</tr>
</tbody>
</table>

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 UL and other 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
- AS/NZS CISPR 11: Group 1, 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.

CE Compliance

This product meets the essential requirements of applicable European Directives, as follows:
• 2014/35/EU; Low-Voltage Directive (safety)
• 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
• 2011/65/EU; Restriction of Hazardous Substances (RoHS)
• 2014/53/EU; Radio Equipment Directive (RED)
• 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

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 Commitment to the Environment 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.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers  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）

中国客户  National Instruments 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 National Instruments 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.)