
PXIe-4163

Specifications



Mess- und Prüftechnik. Die Experten.

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Contents

PXIe-4163 Specifications 3

PXIe-4163 Specifications

PXIe-4163 Specifications

These specifications apply to the PXIe-4163.



Note In this document, the PXIe-4163 (10 pA) and PXIe-4163 (100 pA) are referred to inclusively as the PXIe-4163.

The information in this document applies to all versions of the PXIe-4163 unless otherwise specified. Use the information in the following table to confirm your module variant.

Table 5. PXIe-4163 Variant Identification

Model	Location	Identifying Information
PXIe-4163 (10 pA)	NI Measurement & Automation Explorer (MAX)	PXIe-4163 (10 pA)
	Device Front Panel	PXIe-4163 24-CH 10pA SMU
PXIe-4163 (100 pA)	NI Measurement & Automation Explorer (MAX)	PXIe-4163
	Device Front Panel	PXIe-4163 24-CH Precision SMU

Looking For Something Else?

For information not found in the specifications for your product, such as operating instructions, browse *Related Information*.

Related information:

- [PXIe-4163 User Manual](#)

- [NI-DCPower User Manual](#)

Definitions

Warranted Specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

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**—describes the performance met by a majority of models.
- **Typical-95**—describes the performance met by 95% ($\approx 2\sigma$) of models with a 95% confidence.
- **Nominal**—describes an attribute that is based on design, conformance testing, or supplemental testing.

Values are *Nominal* unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- Ambient temperature¹ of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
- Chassis with slot cooling capacity $\geq 38\text{ W}^2$
 - For chassis with slot cooling capacity = 38 W, fan speed set to HIGH
- Calibration interval of 1 year
- 30 minutes warm-up time
- Self-calibration performed within the last 24 hours
- NI-DCPower Aperture Time is set to 2 power-line cycles (PLC)

PXIe-4163 Pinout

The following figure shows the terminals on the PXIe-4163 connector.

1. The ambient temperature of a PXI system is defined as the temperature at the chassis fan inlet (air intake).
2. For increased capability, NI recommends installing the PXIe-4163 in a chassis with slot cooling capacity $\geq 58\text{ W}$.

Figure 1. PXle-4163 Pinout



Table 6. Signal Descriptions

Signal Name	Description
CH <0..23> Sense LO	Voltage remote sense input terminals. Used to compensate for I^*R voltage drops in cable leads, connectors, and switches.
CH <0..23> Sense HI	Voltage remote sense input terminals. Used to compensate for I^*R voltage drops in cable leads, connectors, and switches.
CH <0..23> Output HI	HI force terminal connected to channel power stage (generates and/or dissipates power). Positive polarity is defined as voltage measured on HI > LO.
CH <0..23> Output LO	LO force terminal connected to channel power stage (generates and/or dissipates power). Positive polarity is defined as voltage measured on HI > LO.
Calibration HI	For external calibration use only, otherwise leave unconnected.



Note The PXle-4163 has 24 channels organized into four cable bundles (A, B, C, D) for use with associated cable accessories.

Instrument Capabilities

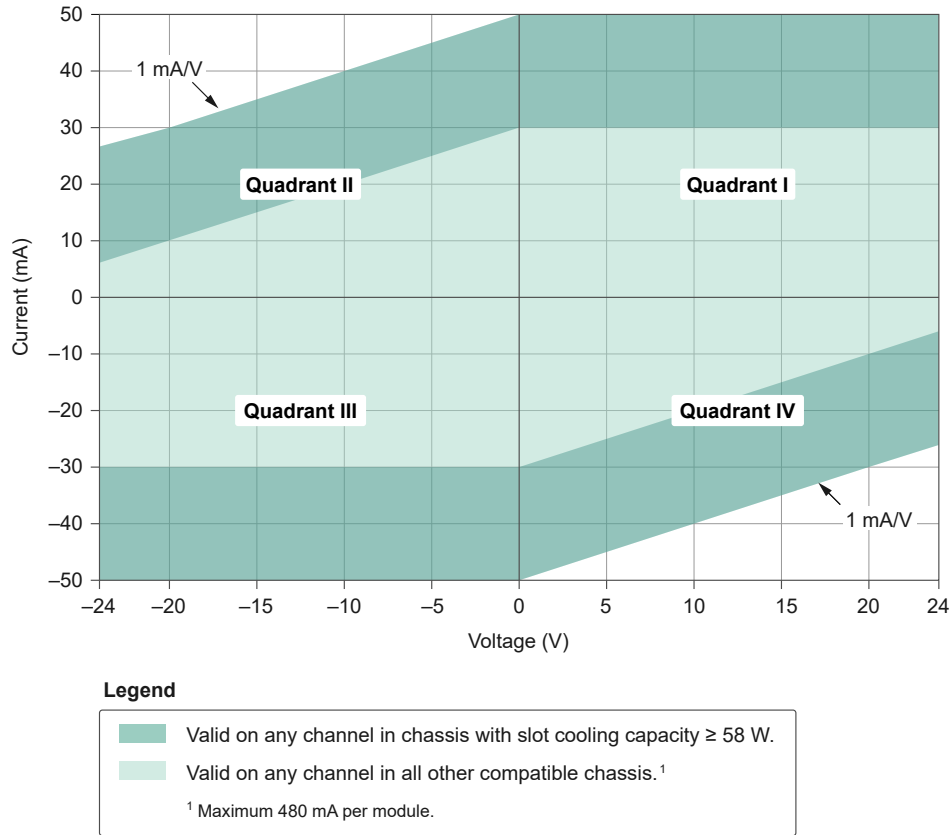
Channels	0 through 23
DC voltage range	± 24 V

The following table and figure illustrate the voltage and the current source and sink ranges of the PXle-4163.

Table 7. PXle-4163 DC Current Source and Sink Ranges, Warranted

Device Model	Chassis Slot Cooling Capacity ≥ 58 W	Chassis Slot Cooling Capacity 38 W
PXle-4163 (10 pA) only	1 μ A	1 μ A
All PXle-4163 models	10 μ A	10 μ A
All PXle-4163 models	100 μ A	100 μ A
All PXle-4163 models	1 mA	1 mA
All PXle-4163 models	10 mA	10 mA
All PXle-4163 models	50 mA	30 mA

Figure 2. PXIe-4163 Quadrant Diagram, Any Channel



Voltage

Table 8. Voltage Programming and Measurement Accuracy/Resolution, Warranted

Range	Resolution and Noise (0.1 Hz to 10 Hz, peak-to-peak, typical)	Accuracy (23 °C \pm 5 °C) \pm (% of Voltage + Offset) ³ $T_{cal} \pm 5$ °C	Tempco ⁴ \pm (% of Voltage + Offset)/°C, 0 °C to 55 °C
24 V	200 μ V	0.05% + 5 mV	0.0005% + 1 μ V

3. Refer to remote sense and load regulation sections for additional accuracy derating and conditions.

4. Temperature coefficient applies beyond 23 °C \pm 5 °C within 5 °C of T_{cal} .

Current

Table 9. PXIe-4163 (10 pA) Current Programming and Measurement Accuracy/Resolution, Warranted

Range	Resolution and Noise (0.1 Hz to 10 Hz, peak-to-peak, typical)	Accuracy (23 °C ± 5 °C) ± (% of Current + Offset) ⁵ $T_{cal} \pm 5 \text{ °C}$	Tempco ⁶ ± (% of Current + Offset)/°C, 0 °C to 55 °C
1 µA	10 pA	0.10% + 100 pA	0.004% + 20 pA
10 µA	100 pA	0.10% + 1 nA	0.004% + 20 pA
100 µA	1 nA	0.10% + 10 nA	0.004% + 100 pA
1 mA	10 nA	0.10% + 100 nA	0.004% + 1 nA
10 mA	100 nA	0.10% + 1 µA	0.004% + 10 nA
30 mA or 50 mA ⁷	500 nA	0.10% + 5 µA	0.004% + 50 nA

Table 10. PXIe-4163 (100 pA) Current Programming and Measurement Accuracy/Resolution, Warranted

Range	Resolution and Noise (0.1 Hz to 10 Hz, peak-to-peak, typical) ⁸	Accuracy (23 °C ± 5 °C) ± (% of Current + Offset) ⁹ $T_{cal} \pm 5 \text{ °C}$	Tempco ¹⁰ ± (% of Current + Offset)/°C, 0 °C to 55 °C
10 µA	100 pA	0.10% + 5 nA	0.004% + 10 pA
100 µA	1 nA	0.10% + 50 nA	0.004% + 100 pA
1 mA	10 nA	0.10% + 500 nA	0.004% + 1 nA

5. Refer to remote sense and load regulation sections for additional accuracy derating and conditions.
6. Temperature coefficient applies beyond 23 °C ± 5 °C within 5 °C of T_{cal} .
7. 50 mA range available only when installed in chassis with slot cooling capacity ≥ 58 W. 30 mA range available in all other chassis.
8. Specified values apply for $V_{output HI} \leq 5$ V; add 0.0002% of range per volt above 5 V.
9. Refer to remote sense and load regulation sections for additional accuracy derating and conditions.
10. Temperature coefficient applies beyond 23 °C ± 5 °C within 5 °C of T_{cal} .

Range	Resolution and Noise (0.1 Hz to 10 Hz, peak- to-peak, typical)	Accuracy (23 °C ± 5 °C) ± (% of Current + Offset) T _{cal} ± 5 °C	Tempco ± (% of Current + Offset)/°C, 0 °C to 55 °C
10 mA	100 nA	0.10% + 5 µA	0.004% + 10 nA
30 mA or 50 mA ¹¹	500 nA	0.10% + 25 µA	0.004% + 50 nA



Note For more information about the impact to specifications when using NI-DCPower Merged Channels, refer to *Effect of Merging Channels on Performance Specifications* in the PXle-4163 User Manual.

Related information:

- [Effect of Merging Channels on Performance Specifications](#)

Available DC Output Power

Chassis Slot Cooling Capacity	Per Channel Maximum	Absolute Maximum
≥58 W	1.2 W	28.8 W
38 W	0.7 W	11.5 W

Additional Specifications

Table 11. Dynamic Specifications

Settling time ¹²	<500 µs, typical ¹³
Transient response ¹⁴	<100 µs, typical ¹⁵

- 50 mA range available only when installed in chassis with slot cooling capacity ≥58 W. 30 mA range available in all other chassis.
- Current limit set to ≥1 mA and ≥10% of the selected current limit range. PXle-4163 configured for fast transient response.
- To settle to 0.1% of voltage step.
- PXle-4163 configured for fast transient response.

Wideband source noise ¹⁶	15 mV RMS, typical <100 mV, peak-to-peak, typical
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Table 12. Remote Sense

Voltage	No additional error due to lead drop
Current	No additional error due to lead drop
Maximum lead drop	1 V

Table 13. Load Regulation

Voltage ¹⁷	50 μ V/mA, typical
Current	(30 pA + 20 ppm of range)/volt, typical ¹⁸

Table 14. Electrical Safety Specifications

Isolation voltage, any pin to earth ground ¹⁹	60 V DC, Measurement Category I, functional
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Table 15. Absolute Maximum Voltage to Output LO

Conditions: Absolute maximum voltage Sense HI measured where $V_{\text{Output HI}}$ is the voltage at the Output HI pin in the same channel as a Sense HI pin.

From Sense HI when $V_{\text{Output HI}} > 0$ V	-0.5 V to ($V_{\text{Output HI}} + 0.5$ V)
From Sense HI when $V_{\text{Output HI}} \leq 0$ V	($V_{\text{Output HI}} - 0.5$ V) to 0.5 V
From all other pins	± 25 V

15. To recover within ± 20 mV after a load current change from 10% to 90% of range.

16. 20 Hz to 20 MHz bandwidth. PXIe-4163 configured for normal transient response. Measured at the end of the 1 m SHDB62M-DB62M-LL cable.

17. At connector pins when using local sense.

18. For more information about the impact to specifications when using NI-DCPower Merged Channels, refer to *Effect of Merging Channels on Performance Specifications* in the PXIe-4163 User Manual.

19. Pins are functionally isolated from chassis ground to prevent ground loops, but do not meet IEC 61010-1 for safety isolation.

! **Notice** Avoid connecting the PXle-4163 output to a voltage that deviates by more than ± 2.5 V from the actual CHx Output HI voltage. When determining this voltage difference, be sure to consider the setpoint, settling, **Output Enabled** status, **Output Connected** status, and compliance. For more information, refer to *Performing Voltage and Current Measurements with the PXle-4163* in the PXle-4163 User Manual.

! **Notice** Exceeding the absolute maximum voltage from Sense HI to Output LO when using remote sense can result in a Remote Sense OVP Error in NI-DCPower 23.0 and later.

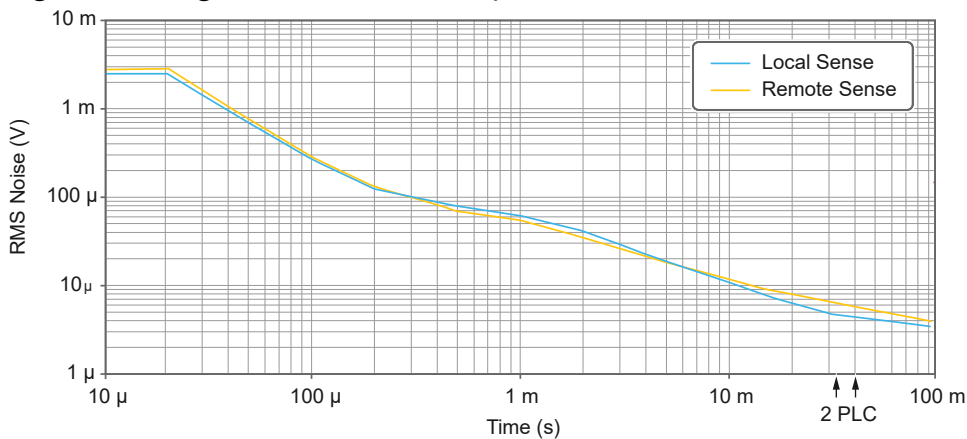
Related information:

- [Performing Voltage and Current Measurements with the PXle-4163](#)

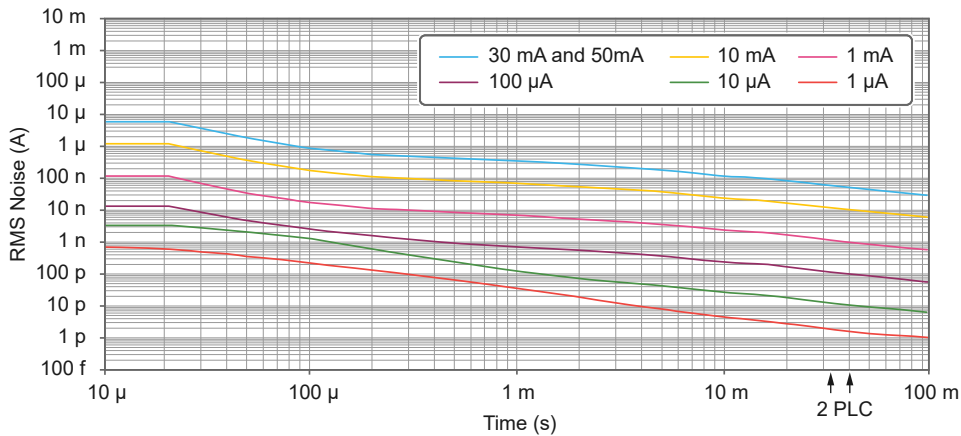
Noise versus Aperture Time

The following figures illustrate noise as a function of measurement aperture for the PXle-4163.

Figure 3. Voltage RMS Noise Versus Aperture Time²⁰



20. All channels averaged. Channels 9 and 22 have degraded performance.

Figure 4. Current RMS Noise Versus Aperture Time^{21, 22}

Note When the aperture time is set to two power-line cycles (PLCs), measurement noise differs slightly depending on whether the NI-DCPower Power Line Frequency is set to 50 Hertz or 60 Hertz.



Note To configure DC Noise rejection, set NI-DCPower DC Noise Rejection to Normal or Second-Order.



Note For more information about the impact to specifications when using NI-DCPower Merged Channels, refer to *Effect of Merging Channels on Performance Specifications* in the PXle-4163 User Manual.

Related information:

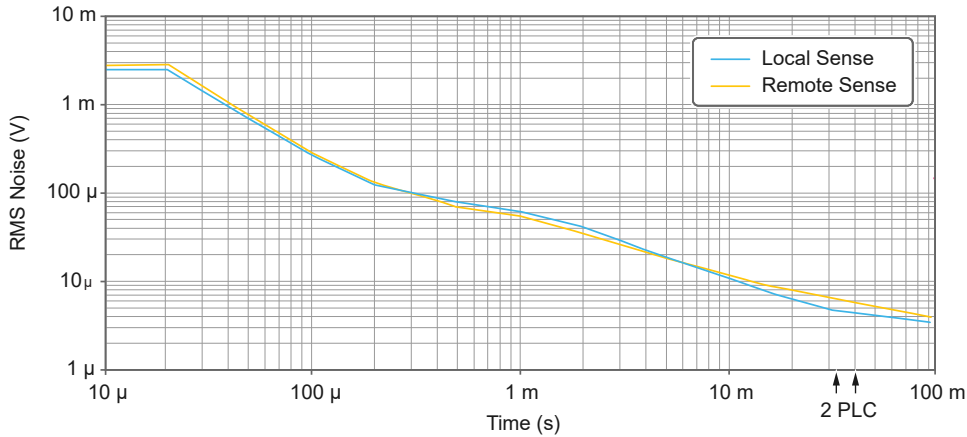
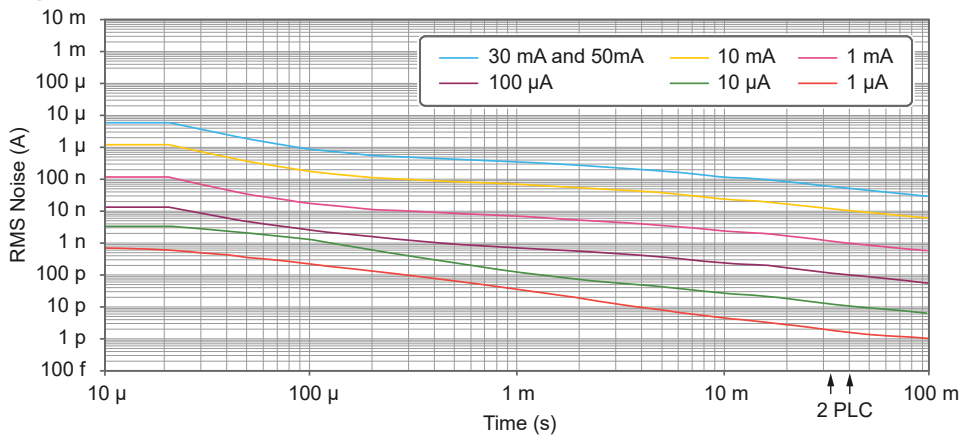
- [Effect of Merging Channels on Performance Specifications](#)

Noise versus Aperture Time

The following figures illustrate noise as a function of measurement aperture for the PXle-4163.

21. The 1 μA range applies only to the PXle-4163 (10 pA).

22. All channels averaged. For the PXle-4163 (100 pA), channels 7, 9, and 11 have degraded performance.

Figure 5. Voltage RMS Noise Versus Aperture Time²³Figure 6. Current RMS Noise Versus Aperture Time^{24, 25}

Note When the aperture time is set to two power-line cycles (PLCs), measurement noise differs slightly depending on whether the NI-DCPower Power Line Frequency is set to 50 Hertz or 60 Hertz.



Note To configure DC Noise rejection, set NI-DCPower DC Noise Rejection to Normal or Second-Order.



Note For more information about the impact to specifications when using NI-DCPower Merged Channels, refer to *Effect of Merging Channels on Performance Specifications* in the PXIe-4163 User Manual.

23. All channels averaged. Channels 9 and 22 have degraded performance.

24. The 1 μ A range applies only to the PXIe-4163 (10 pA).

25. All channels averaged. For the PXIe-4163 (100 pA), channels 7, 9, and 11 have degraded performance.

Measurement and Update Timing

Table 16. Sample Rate Specifications

Available sample rates ²⁶	$(600 \text{ kS/s})/N$ where <ul style="list-style-type: none"> • $N = 6, 7, 8, \dots 2^{20}$ • S is samples
Sample rate accuracy	$\pm 50 \text{ ppm}$
Maximum measure rate to host ²⁷	100,000 S/s per channel, continuous

Table 17. Maximum Source Update Rate



Note As the source delay is adjusted or if advanced sequencing is used, maximum source update rates may vary.

Single channel	100,000 updates/s
All channels simultaneously	40,000 updates/s per channel

Table 18. Input Trigger to

Source event delay	8.5 μs
Source event jitter	1.7 μs
Measure event jitter	1.7 μs

Triggers



Note Pulse widths and logic levels for PXI trigger lines 0 to 7 are compliant with *PXI Express Hardware Specification Revision 1.0 ECN 1*.

26. When source-measuring, both the NI-DCPower Source Delay and Aperture Time properties affect the sampling rate. When taking a measure record, only the Aperture Time property affects the sampling rate.

27. Load dependent settling time is not included. Normal DC noise rejection is used.

Input Triggers

Table 19. Input Trigger Types

Types	Start Source Sequence Advance Measure
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Table 20. Input Trigger Sources (PXI trigger lines 0 to 7)

Polarity	Active high (not configurable)
Minimum pulse width	100 ns

Table 21. Input Trigger Destinations (PXI trigger lines 0 to 7)

Polarity	Active high (not configurable)
Minimum pulse width	>200 ns



Note Input triggers can come from any source (PXI trigger or software trigger) and be exported to any PXI trigger line. This allows for easier multi-board synchronization regardless of the trigger source.

Output Triggers (Events)

Table 22. Output Trigger Types

Types	Source Complete Sequence Iteration Complete Sequence Engine Done Measure Complete
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Table 23. Output Trigger Destinations (PXI trigger lines 0 to 7)

Polarity	Active high (not configurable)
Pulse width	230 ns

Power Requirements

Table 24. 38 W Chassis Slot Cooling Capacity

Power Rail	State	Power Requirement
+3.3 V Current Draw, Typical	Idle	1 A
+3.3 V Current Draw, Typical	Full Output Load	1 A
+12 V Current Draw, Typical	Idle	1.5 A
+12 V Current Draw, Typical	Full Output Load	3 A

Table 25. ≥58 W Chassis Slot Cooling Capacity

Power Rail	State	Power Requirement
+3.3 V Current Draw, Typical	Idle	1 A
+3.3 V Current Draw, Typical	Full Output Load	1 A
+12 V Current Draw, Typical	Idle	1.5 A
+12 V Current Draw, Typical	Full Output Load	4.5 A

Physical

Dimensions	<p>3U, one-slot, PXI Express/CompactPCI Express module</p> <p>2.1 cm × 13.1 cm × 21.4 cm (0.8 in. × 5.1 in. × 8.4 in.)</p> <p>For more information, visit ni.com/dimensions and search by module number.</p>
Weight	394 g (13.9 oz)
Front panel connector	Custom 62-position D-SUB, female

Environmental Guidelines



Notice Failure to follow the mounting instructions in the product documentation can cause temperature derating.



Notice This product is intended for use in indoor applications only.

Environmental Characteristics

Table 26. Temperature

Operating temperature for chassis with slot cooling capacity $\geq 58 \text{ W}^{28}$	0 °C to 55 °C
Operating temperature for all other compatible chassis	0 °C to 40 °C
Storage	-40 °C to 71 °C

Table 27. Humidity

Operating	10% to 90%, noncondensing
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28. Not all chassis with slot cooling capacity $\geq 58 \text{ W}$ can achieve this ambient temperature range. Refer to PXI chassis specifications to determine the ambient temperature ranges your chassis can achieve.

Storage	5% to 95%, noncondensing
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Table 28. Pollution Degree

Pollution degree	2
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Table 29. Maximum Altitude

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
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Table 30. Shock and Vibration

Operating vibration	5 Hz to 500 Hz, 0.3 g RMS
Non-operating vibration	5 Hz to 500 Hz, 2.4 g RMS
Operating shock	30 g, half-sine, 11 ms pulse

Calibration Interval

You can obtain the calibration certificate and information about calibration services for the PXIe-4163 at ni.com/calibration.

Table 31. Calibration Interval

Calibration Interval	1 year
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