PXIe-4151

Specifications

Contents

PXIe-4151 Specifications

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*** 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.

Specifications are ***Warranted*** unless otherwise noted.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- Ambient temperature[1] of 23 °C ± 5 °C.
- Chassis with ≥38 W slot cooling capacity.[2]
  - For chassis with slot cooling capacity = 38 W, fan speed set to HIGH
- Calibration interval of 2 years.
- Warm-up time of 30 minutes.
- Self-calibration performed within the last 24 hours.
- NI-DCPower Aperture Time is set to 1 power-line cycle (PLC).

Pinout

Use the pinouts to connect to terminals on the PXIe-4151.

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-4151 in a chassis with slot cooling capacity ≥58 W.

Output Connector

Figure 1. Output Connector Pinout

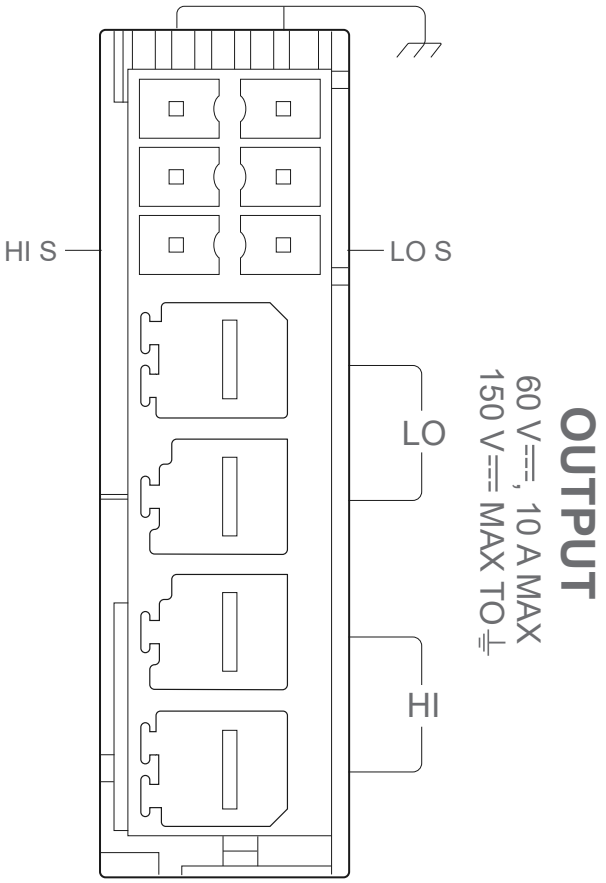


Table 5. Output Connector Pin Descriptions

Pin	Description
HI terminal	HI force terminal connected to channel power stage (generates and/or dissipates power). Positive polarity is defined as voltage measured on HI > LO.
LO terminal	LO force terminal connected to channel power stage (generates and/or dissipates power). Positive polarity is defined as voltage measured on HI > LO.
HI S terminal	Voltage remote sense input terminals. Used to compensate for I x R voltage drops in cable leads, connectors, and switches.
LO S terminal	
GND (⏚) terminals	Tied to chassis ground through module front panel. Use for connections to cable shields. Do

Pin	Description
	not use for grounding the LO force terminal due to pin current rating.

AUX I/O Connector

Figure 2. AUX I/O Connector Pinout

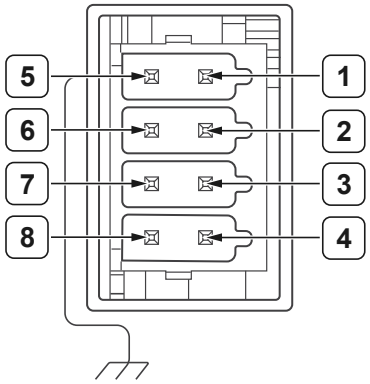


Table 6. AUX I/O Connector Pin Descriptions

Pin		Descriptions
1	PFI 0	Programmable Function Interface for digital timing and triggering.
2	PFI 1	
3	FAULT	Device fault status output.
4	INHIBIT	Forces the power supply output to an inhibited state when not shorted to ground. You can short this pin to ground using the pre-installed jumper to enable normal operation.
5	GND	Ground reference for AUX I/O.
6	PFI 2	Programmable Function Interface for digital timing and triggering.
7	GND	Ground reference for AUX I/O.
8	GND	

AUX Power In Connector

Figure 3. AUX Power In Connector Pins

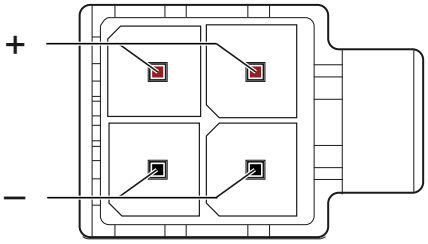


Table 7. AUX Power In Connector Pin Descriptions

Signal	Descriptions
+	Positive Auxiliary Power Input
-	Negative Auxiliary Power Input

Instrument Capabilities

DC voltage ranges	6 V, 20 V
DC current ranges	100 mA, 1 A, 25 A

Note Maximum current allowed in the 25 A range is dependent on ambient temperature and chassis cooling capacity. Refer to the following figures for additional detail.

Figure 4. PXIe-4151 Quadrant Diagram, $T_{ambient}$ = 0 °C to 40 °C

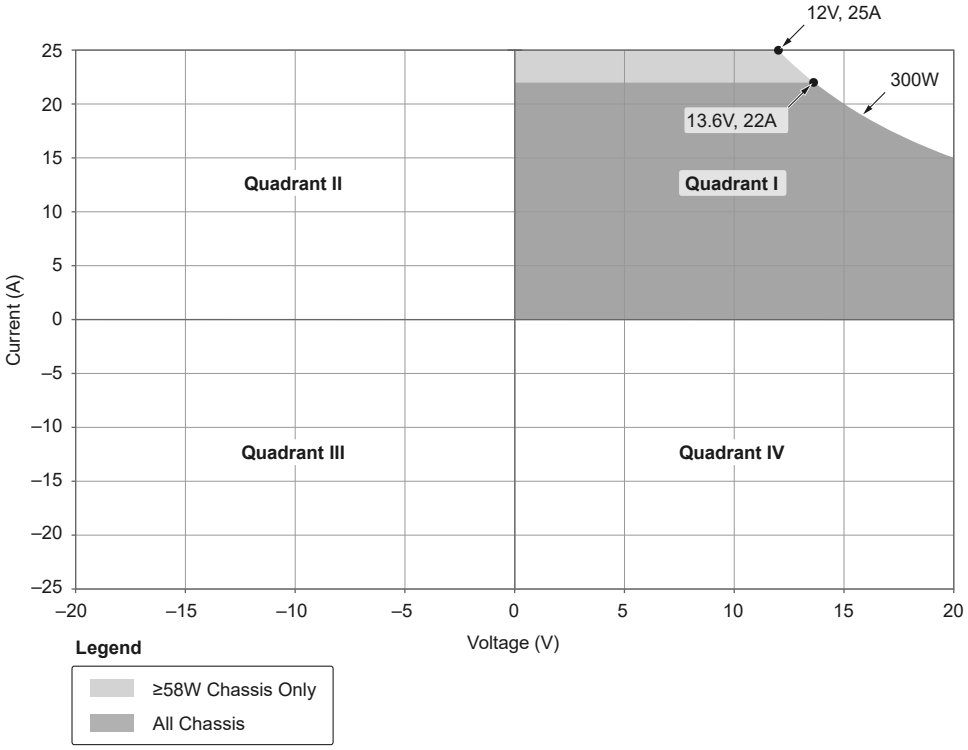
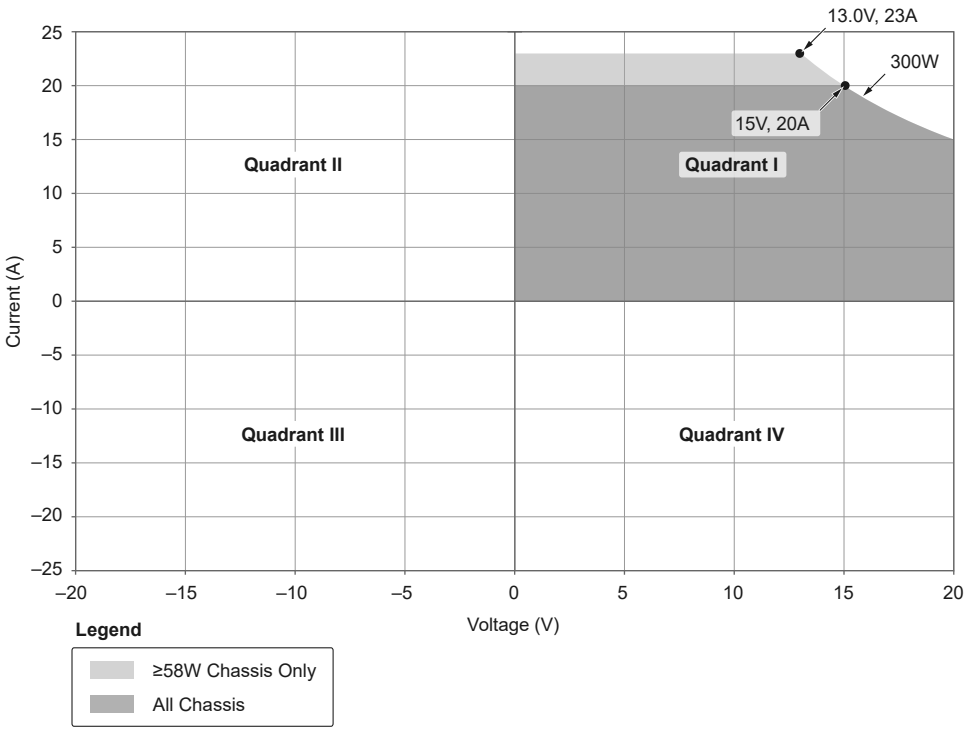


Figure 5. PXIe-4151 Quadrant Diagram, $T_{ambient}$ >40 °C



Available DC output power[3]	300 W

Note An auxiliary power source with sufficient capacity is required for operation. Refer to ***Power Requirements*** for additional details.

Related reference:

- Power Requirements

Voltage

Table 8. Voltage Programming and Measurement Accuracy/Resolution

Range	Resolution (Noise Limited)	Noise (0.1 Hz to 10 Hz, peak-to-peak, typical)	Accuracy ± (% of Voltage + Offset)[4]	Tempco[5] ± (% of Voltage + Offset)/°C
			$T_{ambient}$ 23 °C ± 5 °C, T_{cal}[6] ± 5 °C	$T_{ambient}$ 0 °C to 55 °C, T_{cal} ± 5 °C
6 V	1 µV	10 µV	0.022% + 500 µV	0.001% + 25 µV
20 V	10 µV	40 µV	0.024% + 2 mV	0.001% + 65 µV

Related reference:

- Remote Sense
- Load Regulation

3. Power limit defined by voltage measured between HI and LO terminals.
4. Refer to the ***Remote Sense*** and ***Load Regulation*** sections for additional accuracy derating and conditions.
5. Temperature coefficient applies beyond 23 °C ± 5 °C ambient within ± 5 °C of T_{cal}.
6. T_{cal} is the internal device temperature recorded by the PXIe-4151 at the completion of the last self-calibration.

Current

Table 9. Current Programming and Measurement Accuracy/Resolution

Range	Resolution (Noise Limited)	Noise (0.1 Hz to 10 Hz, peak-to-peak, typical)	Accuracy ± (% of Current + Offset)[7]	Tempco[8] ± (% of Current + Offset)/°C
			$T_{ambient}$ 23 °C ± 5 °C, T_{cal}[9] ± 5 °C	$T_{ambient}$ 0 °C to 55 °C, T_{cal} ± 5 °C
100 mA	10 nA	200 nA	0.03% + 30 µA	0.0015% + 1.5 µA
1 A	100 nA	2 µA	0.03% + 300 µA	0.0015% + 15 µA
25 A	10 µA	160 µA	0.065% + 2 mA	0.0035% + 375 µA

Related reference:

- Remote Sense
- Load Regulation

Noise

Wideband source noise[10]	<20 mV peak-to-peak, typical

The following figures illustrate measurement noise as a function of measurement aperture time for the PXIe-4151.

7. Refer to the ***Remote Sense*** and ***Load Regulation*** sections for additional accuracy derating and conditions.
8. Temperature coefficient applies beyond 23 °C ± 5 °C ambient within ± 5 °C of T_{cal}.
9. T_{cal} is the internal device temperature recorded by the PXIe-4151 at the completion of the last self-calibration.
10. 10 Hz to 20 MHZ bandwidth, measured with 1 µF load capacitance at the end of 1 m shielded cable. PXIe-4151 configured for normal transient response.

Figure 6. Voltage RMS Noise Versus Aperture Time, Nominal

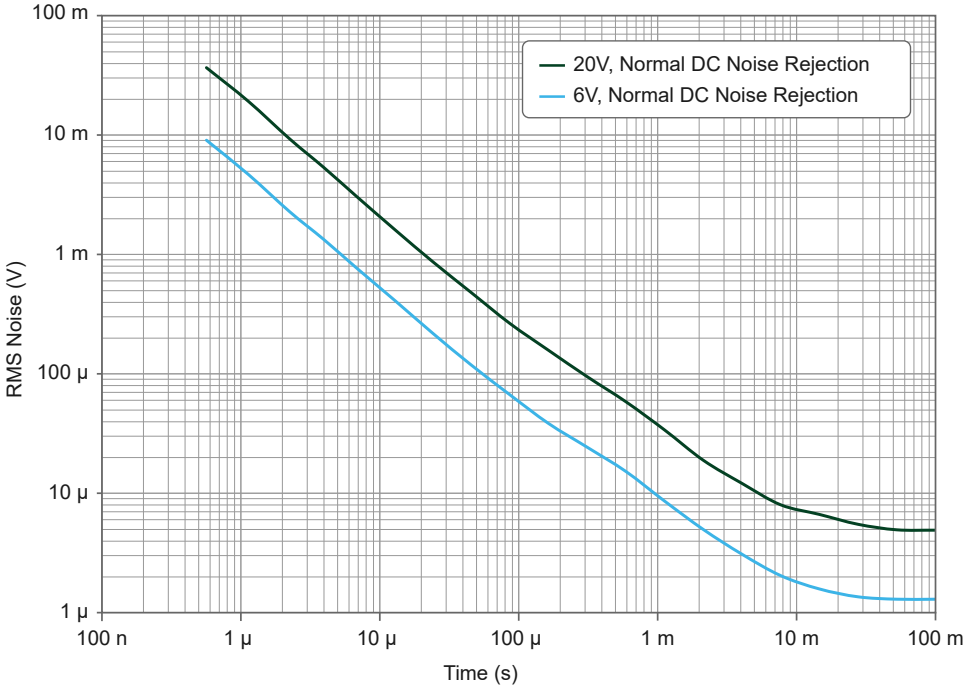
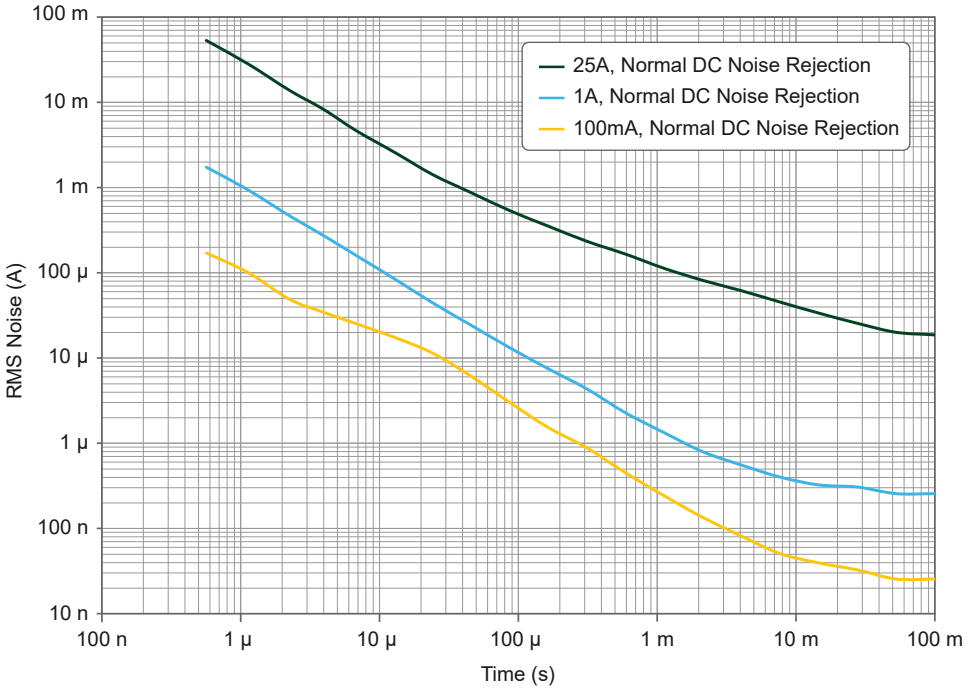


Figure 7. Current RMS Noise Versus Aperture Time, Nominal



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

Note Use the DC Noise Rejection property to configure normal or second-order DC noise rejection.

Settling Time and Transient Response

Note Settling time is measured as the time to settle to within 0.1% of step amplitude, PXIe-4151 configured for fast transient response.

Settling Time	
Voltage mode, ≤18 V step, unloaded	<4.2 ms, typical
Current mode, full-scale step, 25 A range	<600 µs, typical
Current mode, full-scale step, 1 A range	<320 µs, typical
Current mode, full-scale step, 100 mA range	<1.2 ms, typical

Note Settling time specifications for voltage mode derived with current limit set to ≥20% of the selected current limit range.

Note Settling time specifications for current mode (all ranges) derived with voltage limit set to ≥2 V, resistive load set to 1 V/selected current range.

Transient Response	
25 A range	<250 µs, typical to recover within ±300 mV
1 A range	<50 µs, typical to recover within ±10 mV

Note Transient response is the time to recover within the stated recovery band after a load current change from 50% to 100% of range, PXIe-4151 configured for fast transient response.

Remote Sense

Voltage accuracy	Add 10 µV per volt of lead drop per ohm of corresponding sense lead resistance to voltage accuracy specifications.
Maximum sense lead resistance	100 Ω
Maximum lead drop per lead	1 V, maximum 20 V between HI and LO terminals

Load Regulation

Voltage, local sense[11]	5 µV/mA (5 mΩ), nominal; 11 µV/mA (11 mΩ), maximum
Voltage, remote sense	Error included in accuracy specifications.
Current	Error included in accuracy specifications.

Auxiliary Power Input Line Regulation

Note Auxiliary power input line regulation is the impact to voltage and current accuracy specifications as a result of change in voltage at the auxiliary power input.

11. Measured between HI and LO terminals at the module output connector.

Voltage	Error included in accuracy specifications.
Current	Error included in accuracy specifications.

Isolation

Isolation voltage, any channel I/O pin[12] to earth ground	150 V DC, CAT I
Transient overvoltage	800 V peak

Caution Isolation voltage ratings apply to the voltage measured between any channel pin (HI, LO, HI Sense, LO Sense) and the chassis ground. When operating channels in series or floating on top of external voltage references, ensure that no terminal exceeds this rating.

Caution Les tensions nominales d'isolation s'appliquent à la tension mesurée entre n'importe quelle broche de voie et la masse du châssis. Lors de l'utilisation de voies en série ou flottantes en plus des références de tension externes, assurez-vous qu'aucun terminal ne dépasse cette valeur nominale.

Note Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are for other circuits not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

12. Channel I/O pins include the HI, LO, HI Sense and LO Sense terminals. The Shield GND terminals of the output connector are connected to chassis ground and not considered channel I/O pins.

Protection

Absolute maximum voltage	
Between any channel I/O pin[13] and LO	60 V
Any AUX I/O pin to ground	5 V
AUX Power In + to AUX Power In –	±60 V
AUX Power In – to ground	±1 V

Output channel protection	
Overcurrent or overvoltage	Automatic shutdown, output disconnect relay opens
Reverse voltage protection	Automatic shutdown, output disconnect relay opens
Down programmer overload	Automatic shutdown, output disconnect relay opens
Overtemperature	Automatic shutdown, output disconnect relay opens

AUX Power protection	
Overvoltage or undervoltage	Automatic shutdown, output disconnect relay opens

13. Channel I/O pins include the HI, LO, HI Sense and LO Sense terminals. The Shield GND terminals of the output connector are connected to chassis ground and not considered channel I/O pins.

Overcurrent	Automatic shutdown, output disconnect relay opens, non-accessible fuse as backup protection

Measurement and Update Timing

Available sample rates[14]	(1.8 MS/s)/N, nominal

where

- S is samples
- N = 1, 2, 3, … 2^{24}

Sample rate accuracy	Equal to PXIe_CLK100 accuracy, nominal
Maximum measure rate to host	1.8 MS/s per channel, continuous, nominal
Maximum source update rate[15]	100,000 updates/s, nominal

Input trigger to	
Source event delay	10 µs, nominal
Source event jitter	2 µs peak-to-peak, nominal

14. When sourcing while measuring, both the Source Delay and Aperture Time affect the sampling rate. When taking a measure record, only the Aperture Time affects the sampling rate.
15. As the Source Delay is adjusted, or if advanced sequencing is used, maximum update rates vary.

Measure event jitter	2 µs peak-to-peak, nominal

Triggers

Input Triggers

Types	Start, Source, Sequence Advance, Measure

Sources (PXI trigger lines <0...7>[16]	
Polarity	Active high (not configurable)
Minimum pulse width	100 ns

Destinations[17] **(PXI trigger lines <0...7>)**[18]	
Polarity	Active high (not configurable)
Pulse width	>200 ns

Output Triggers (Events)

Types	Source Complete, Sequence Iteration Complete, Sequence Engine Done, Measure Complete

16. Pulse widths and logic levels are compliant with ***PXI Express Hardware Specification Revision 1.0 ECN 1***.
17. 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.
18. As the Source Delay is adjusted, or if advanced sequencing is used, maximum update rates vary.

Destinations (PXI trigger lines <0...7>)[19]	
Polarity	Active high (not configurable)
Pulse width	>230 ns

Physical

Dimensions	3U, two-slot, PXI Express/CompactPCI Express module 4.0 cm × 13.0 cm × 21.6 cm (1.6 in. × 5.1 in. × 8.5 in.)
Weight	650 g (22.9 oz)

Front Panel Connectors	
Output	OMNIMATE Hybrid, 7.62 mm (4 position), 2.54 mm (6 position)
AUX I/O	MICRO COMBICON - DFMC 0, 5, 2.54 mm (8 position)
AUX Power In	MEGA-FIT RECEPTACLE, 5.7 mm, (4 position)

Calibration Interval

Recommended calibration interval	2 years

19. As the Source Delay is adjusted, or if advanced sequencing is used, maximum update rates vary.

Power Requirements

PXIe chassis, +3.3 V	1 A, maximum
PXIe chassis, +12 V	1 A, maximum
Auxiliary power source input	45.6 V DC to 50.4 VDC, 9 A maximum

Note Current drawn from the auxiliary power source depends on power delivered from the instrument to the load. Refer to the PXIe-4151 user manual for additional details on power budgeting when multiple modules are powered from a single auxiliary power source.

Environmental Characteristics

Temperature	
Operating	0 °C to 55 °C[20,21]
Storage	-40 °C to 71 °C
Humidity	
Operating	10% RH to 90% RH, noncondensing
Storage	5% RH to 95% RH, noncondensing

20. Not all chassis can achieve this ambient temperature range. Refer to PXI chassis specifications to determine the ambient temperature ranges your chassis can achieve.
21. Maximum ambient temperature deratings apply when operating the 25 A range above certain current levels. Refer to the ***Instrument Capabilities*** section for additional details.

Pollution Degree	2
Maximum Altitude	2000 m

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

Related reference:

- Instrument Capabilities