PXIe-4142 Specifications

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Contents

PXIe-4142 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
- Calibration interval of 1 year
- 30 minutes warm-up time
- Self-calibration performed within the last 24 hours
- niDCPower Aperture Time property or NIDCPOWER_ATTR_APERTURE_TIME attribute set to 2 power-line cycles (PLC)
- Fans set to the highest setting if the PXI Express chassis has multiple fan speed settings

[1] The ambient temperature of a PXI system is defined as the temperature at the chassis fan inlet (air intake).

Device Capabilities

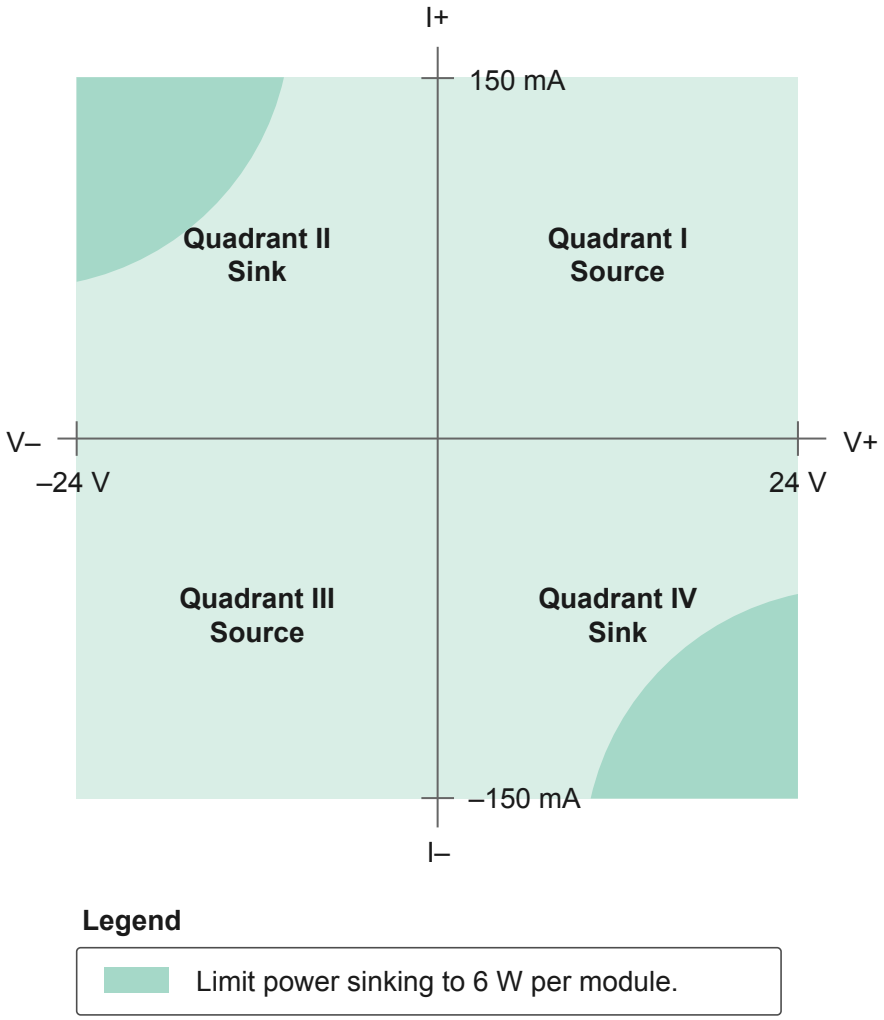
The following table and figure illustrate the voltage and the current source and sink ranges of the PXIe-4142.

Table 1. PXIe-4142 Current Source and Sink Ranges

Channels	DC Voltage Ranges	DC Current Source and Sink Ranges
0 through 3*	±24 V	▪ 10 µA ▪ 100 µA ▪ 1 mA ▪ 10 mA ▪ 150 mA

* Channels are isolated from earth ground but share a common LO.

Figure 1. PXIe-4142 Quadrant Diagram, All Channels



SMU Specifications

Voltage Programming and Measurement Accuracy/Resolution

Table 2. Voltage Programming and Measurement Accuracy/Resolution

Range	Resolution and noise (0.1 Hz to 10 Hz)	Accuracy (23 °C ± 5 °C) ± (% of voltage + offset),[2] T_{cal}±5 °C	Temperature Coefficient ± (% of Voltage + Offset) / °C[3], 0 °C to 55 °C
24 V	200 µV	0.1% + 10 mV	0.0005% + 1 µV

Related tasks:

- Calculating SMU Resolution

Related reference:

- Additional Specifications

Current

Table 3. Current Programming and Measurement Accuracy/Resolution

Range	Resolution and noise (0.1 Hz to 10 Hz)	Accuracy (23 °C ± 5 °C) ± (% of current + offset), T_{cal} ±5 °C	Tempco ± (% of current + offset)/°C, 0 °C to 55 °C [4]
10 µA	100 pA	0.1% + 5.0 nA	0.002% + 10 pA
100 µA	1 nA	0.1% + 50 nA	0.002% + 100 pA
1 mA	10 nA	0.1% + 0.5 µA	0.002% + 1.0 nA
10 mA	100 nA	0.1% + 5.0 µA	0.002% + 10 nA
150 mA	1.5 µA	0.1% + 75 µA	0.002% + 150 nA

Related tasks:

- Calculating SMU Resolution

[2] Accuracy is specified for no load output configurations. Refer to Load Regulation and Remote Sense in the **Additional Specifications** section for additional accuracy derating and conditions.
[3] Temperature Coefficient applies beyond 23 °C ± 5 °C within a given tolerance of Tcal.
[4] Temperature Coefficient applies beyond 23 °C ± 5 °C within a given tolerance of Tcal.

Related reference:

- Additional Specifications

Example of Calculating SMU Resolution

The PXIe-4142 has a resolution of 1,000 ppm when set to a 100 µs aperture time. In the 24 V range, resolution can be calculated by multiplying 24V by 1,000 ppm, as shown in the following equation:

$24\ V * 1{,}000\ ppm = 24\ V * 1{,}000 * 1 \times 10^{-6} = 24\ mV$

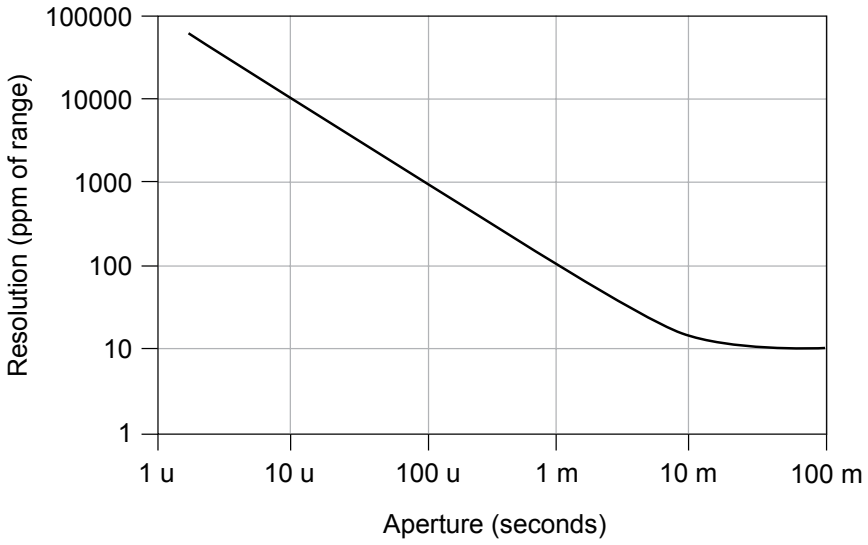
Likewise, in the 150 mA range, resolution can be calculated by multiplying 150 mA by 1,000 ppm, as shown in the following equation:

$150\ mA * 1{,}000\ ppm = 150\ mA * 1{,}000 * 1 \times 10^{-6} = 150\ \mu A$

Calculating SMU Resolution

Refer to the following figure as you complete the following steps to derive a resolution in absolute units:

Figure 2. Noise and Resolution versus Measurement Aperture, Typical



1. Select a voltage or current range.

2. For a given aperture time, find the corresponding resolution.
3. To convert resolution from ppm of range to absolute units, multiply resolution in ppm of range by the selected range.

Additional Specifications

Settling time[5]	<100 µs to settle to 0.1% of voltage step, device configured for fast transient response, typical
Transient response	<100 µs to recover within ±20 mV after a load current change from 10% to 90% of range, device configured for fast transient response, typical
Wideband source noise[6]	2 mV RMS, typical <20 mV_{pk-pk}, typical
Cable guard output impedance	10 kΩ, typical

Remote sense	
Voltage	Add 0.1% of LO lead drop to voltage accuracy specification
Current	Add 0.03% of range per volt of total HI and LO lead drop to current accuracy specification
Maximum lead drop	Up to 1 V drop per lead

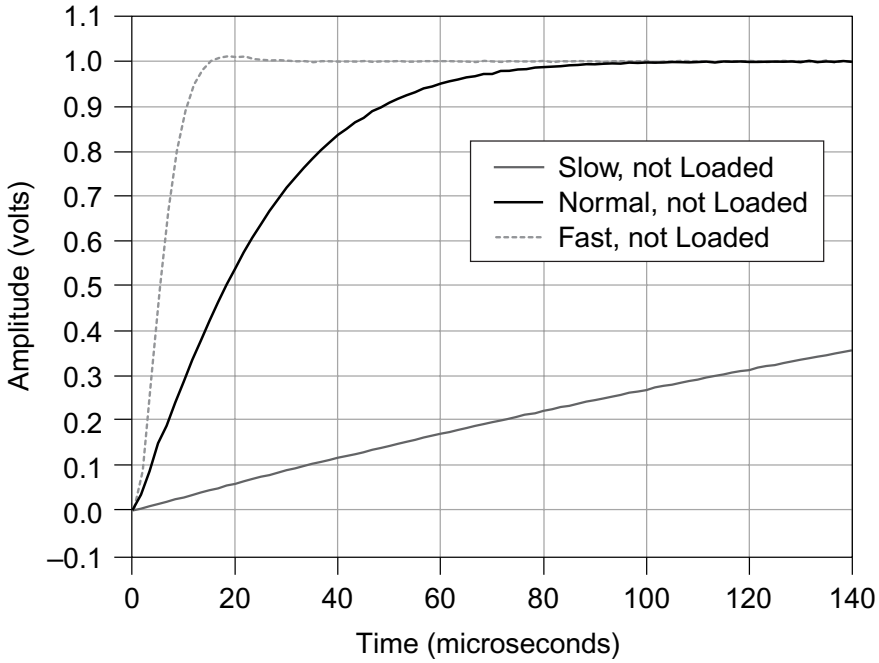
Load regulation	
Voltage	10 µV at connector pins per mA of output load when using local sense, typical

[5] Current limit set to ≥1 mA and ≥10% of the selected current limit range.
[6] 20 Hz to 20 MHz bandwidth. PXIe-4142 configured for normal transient response.

Current	20 pA + (10 ppm of range per volt of output change) when using local sense, typical
Isolation voltage, channel-to-earth ground[7]	60 VDC, CAT I, verified by dielectric withstand test, 5 s, continuous
Absolute maximum voltage between any terminal and LO	30 VDC, continuous

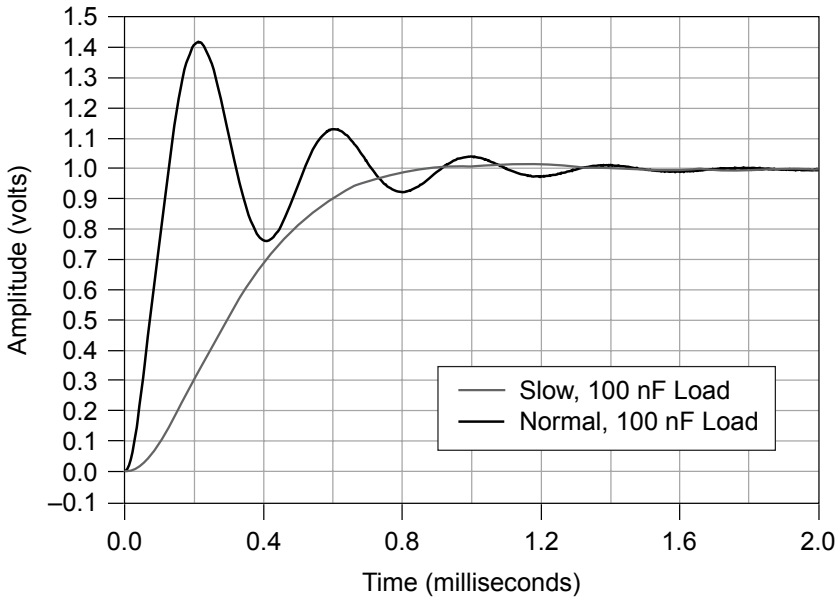
The following figures illustrate the effect of the transient response setting on the step response of the PXIe-4142 for different loads.

Figure 3. 1 mA Range No Load Step Response, Typical



[7] Channels are isolated from earth ground but share a common LO.

Figure 4. 1 mA Range, 100 nF Load Step Response, Typical



Supplemental Specifications

Measurement and Update Timing

Available sample rates[8]	(600 kS/s)/N

where

- N = 6, 7, 8, … 2^{20}
- S is samples

Sample rate accuracy	±50 ppm
Maximum measure rate to host[9]	600,000 S/s per channel, continuous

[8] 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.

[9] Load dependent settling time is not included. Normal DC noise rejection is used.

Maximum source update rate[10]	
Sequence length <300 steps per iteration	100,000 updates/s per channel
Sequence length ≥300 steps per iteration	100,000 updates/s per board
Input trigger to	
Source event delay	5 µs
Source event jitter	1.7 µs
Measure event jitter	1.7 µs

Triggers

Input triggers	
Types	Start Source Sequence Advance Measure
Sources (PXI trigger lines 0 to 7)	
Polarity	Configurable
Minimum pulse width	100 ns, nominal
Destinations[11] **(PXI trigger lines 0 to 7)**	

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

[11] 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.

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

Output triggers (events)	
Types	Source Complete Sequence Iteration Complete Sequence Engine Done Measure Complete
Destinations (PXI trigger lines 0 to 7)	
Polarity	Configurable
Pulse width	Configurable between 250 ns and 1.6 µs, nominal

Note Pulse widths and logic levels are compliant with **PXI Express Hardware Specification Revision 1.0 ECN 1**.

Calibration Interval

Recommended calibration interval	1 year

Physical

Dimensions	3U, one-slot, PXI Express/CompactPCI Express module

	2.0 cm × 13.0 cm × 21.6 cm (0.8 in. × 5.1 in. × 8.5 in.)
Weight	412 g (14.53 oz)
Front panel connectors	25-position D-SUB, male

Power Requirements

PXI Express power requirement	2 A from the 12 V rail and 1.9 A from the 3.3 V rail

Environmental Characteristics

Temperature	
Operating	0 °C to 55 °C
Storage	-40 °C to 70 °C
Humidity	
Operating	10% to 70%, noncondensing. Derate 1.3% per °C above 40 °C
Storage	5% to 95%, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
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

PXIe-4142 Pinout

The following figure shows the terminals on the PXIe-4142 connector.

Figure 5. PXIe-4142 Connector Pinout

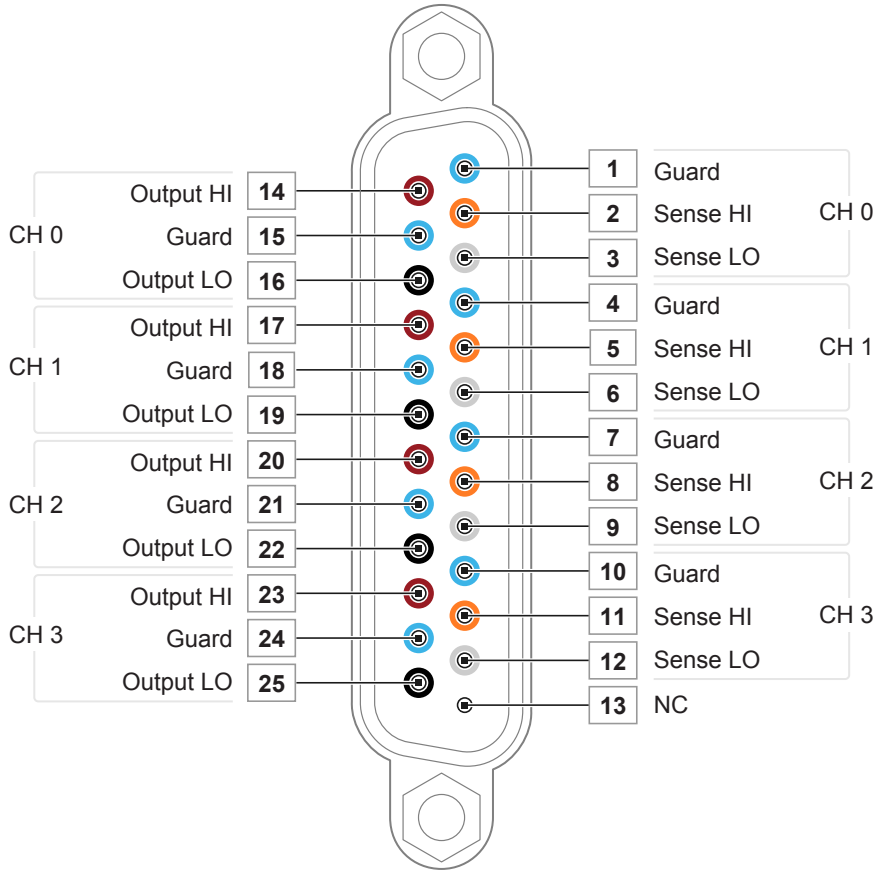


Table 4. Signal Descriptions

Signal Name	Description
CH <0..3> 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.

Signal Name	Description
CH <0..3> Guard	Buffered output that follows the voltage of the HI force terminal. Used to drive shield conductors surrounding HI force and Sense HI conductors to minimize effects of leakage and capacitance on low level currents.
CH <0..3> 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.
CH <0..3> Sense HI	Voltage remote sense input terminals. Used to compensate for **I*R** voltage drops in cable leads, connectors, and switches.
CH <0..3> Sense LO	
NC	No Connect.

Note PXIe-4142 channels are bank-isolated from earth ground, but also share a common LO.

PXIe-4143 Pinout

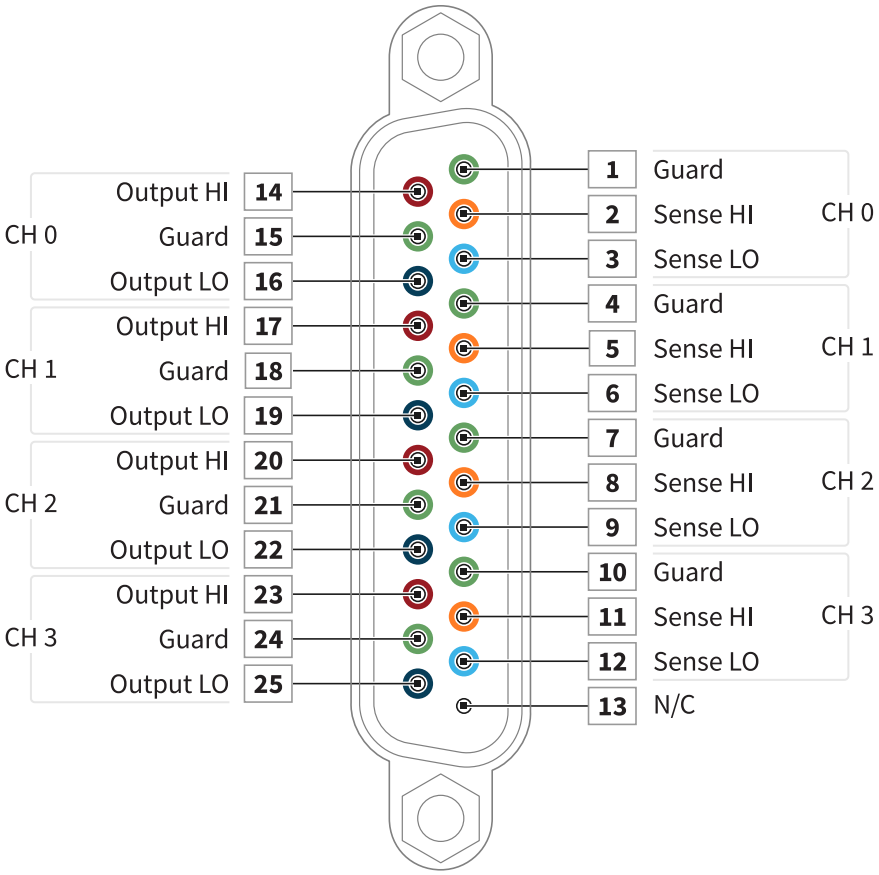


Table 5. Signal Descriptions

Pin	Description
A	Access Status Indicator LED
B	Active Status Indicator LED
1	CH 0, Pin 1, Guard
2	CH 0, Pin 2, Sense HI
3	CH 0, Pin 3, Sense LO
4	CH 1, Pin 4,Guard
5	CH 1, Pin 5, Sense HI
6	CH 1, Pin 6, Sense LO

Pin	Description
7	CH 2, Pin 7, Guard
8	CH 2, Pin 8, Sense HI
9	CH 2, Pin 9, Sense LO
10	CH 3, Pin 10, Guard
11	CH 3, Pin 11, Sense HI
12	CH 3, Pin 12, Sense LO
13	N/C
14	CH 0, Pin 14, Output HI
15	CH 0, Pin 15, Guard
16	CH 0, Pin 16, Output LO
17	CH 1, Pin 17, Output HI
18	CH 1, Pin 18, Guard
19	CH 1, Pin 19, Output LO
20	CH 2, Pin 20, Output HI
21	CH 2, Pin 21, Guard
22	CH 2, Pin 22, Output LO
23	CH 3, Pin 23, Output HI
24	CH 3, Pin 24, Guard
25	CH 3, Pin 25, Output LO