PXIe-6570

2025-03-13

Contents

PXIe-6570 Specifications

These specifications apply to the PXIe-6570. When using the PXIe-6570 in the Semiconductor Test System, refer to the ***Semiconductor Test System Specifications***.

Definitions

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.

Conditions

Specifications are valid under the following conditions unless otherwise noted.

- Operating temperature of 0 °C to 45 °C
- Operating temperature within ±5 °C of the last self-calibration temperature
- Recommended calibration interval of 1 year. The PXIe-6570 will not meet specifications unless operated within the recommended calibration interval.
- DUT Ground Sense (DGS) same potential as the Ground (GND) pins

> **Note** The DGS feature is only available on PXIe-6570 module revisions 158234**C**-xxL or later.

- Chassis fans set to the highest setting if the PXI Express chassis has multiple fan speed settings
- 30-minute warmup time before operation

> **Note** When the pin electronics on the PXIe-6570 are in the disconnect state, some I/O protection and sensing circuitry remain connected. Do not subject the PXIe-6570 to voltages beyond the supported measurement range.

General

Channel count	32
Multi-site resources per instrument	
NI-Digital 16.0	4
NI-Digital 17.0 and later	8
System channel count[1]	256
Large Vector Memory (LVM)	128M vectors
History RAM (HRAM)	
NI-Digital 17.5 and earlier	1,023 cycles
NI-Digital 18.0 and later	(8,192/N sites)-1 cycles
Maximum allowable offset (DGS minus GND)	±300 mV

Supported measurement range[2]	-2 V to 7 V[3]

Timing

Vector Timing

Maximum vector rate	100 MHz
Vector period range	10 ns to 40 µs (100 MHz to 25 kHz)
Vector period resolution	38 fs
Timing control	
Vector period	Vector-by-vector on the fly
Edge timing	Per channel, vector-by-vector on the fly
Drive formats	Per channel, vector-by-vector on the fly

Clocking

Master clock source	PXIe_CLK100[4]
Sequencer clock domains	One (independent sequencer clock domains on a single instrument not supported)

Drive and Compare Formats

Drive formats[5]	
100 MHz maximum vector rate	Non-Return (NR), Return to Low (RL), Return to High (RH)
50 MHz maximum vector rate	Surround by Complement (SBC)[6]
Compare formats	Edge strobe

Edge Multipliers[5]	
NI-Digital 17.5 and earlier	1x
NI-Digital 18.0 and later	1x, 2x

Figure 1. Drive Formats

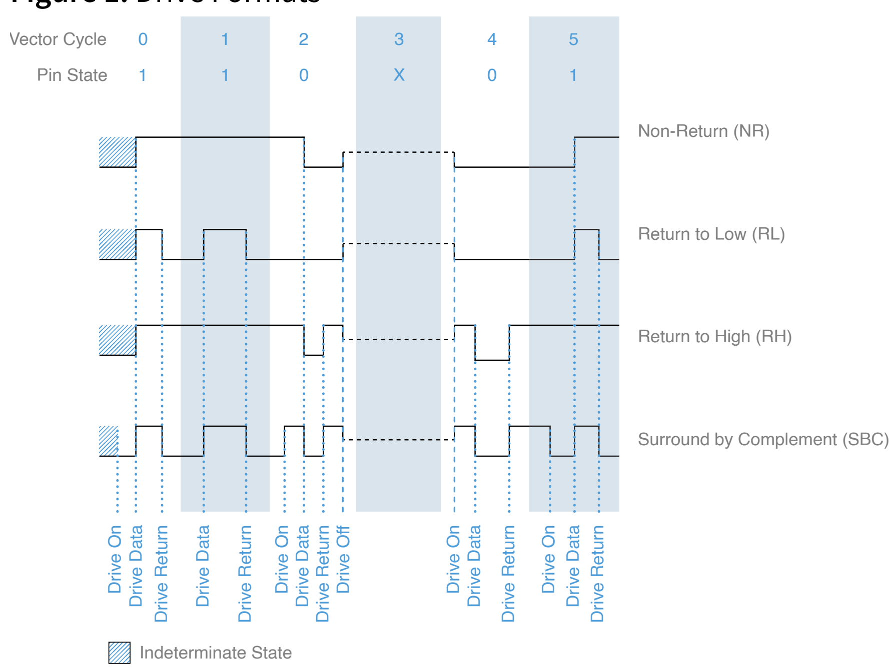
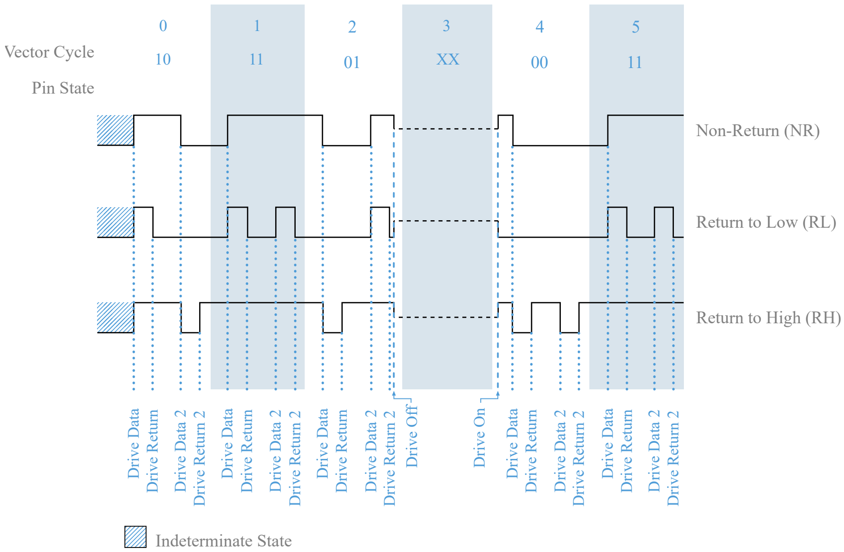


Figure 2. 2x Mode Drive Formats



Pin Data States

Pin States

- 0 — Drive zero.
- 1 — Drive one.
- L — Compare low.
- H — Compare high.
- X — Do not drive; mask compare.
- M — Compare midband, not high or low.
- V — Compare high or low, not midband; store results from capture functionality if configured.
- D — Drive data from source functionality if configured.
- E — Expect data from source functionality if configured.[7]
- - — Repeat previous cycle. Do not use a dash (–) for the pin state on the first vector of a pattern file unless the file is used only as a target of a jump or call operation.

> **Note** Termination mode settings affect the termination applied to all non-driving pin states. Non-drive states include L, H, M, V, X, E, and potentially -. Refer to the Programmable input termination mode specification for more information.

Edge Timing

Edge Types

Drive edges	
NI-Digital 17.5 and earlier	4; drive on, drive data, drive return
NI-Digital 18.0 and later	6; drive on, drive data, drive return, drive data 2, drive return 2, drive off
Compare edges	
NI-Digital 17.5 and earlier	1; strobe
NI-Digital 18.0 and later	2; strobe, strobe 2
Number of time sets[8]	31

Edge Generation Timing

Edge placement range	
Minimum	Start of vector period (0 ns)
Maximum	5 vector periods or 40 µs, whichever is smaller
Minimum required edge separation	
Between any driven data change	
NI-Digital 17.5 and earlier	5 ns

NI-Digital 18.0 and later	3.75 ns
Between any Drive On and Drive Off edges	5 ns
Between Compare Strobes	5 ns
Edge placement resolution	39.0625 ps
Edge placement accuracy: Drive[9]	
NI-Digital 17.5 and earlier	
Edge Multiplier = 1x	±500 ps, warranted
NI-Digital 18.0 and later	
Edge Multiplier = 1x	±500 ps, warranted
Edge Multiplier = 2x	Bit rate ≤ 200 Mbps: ±500 ps, typical
Edge Multiplier = 2x	Bit rate ≤ 266 Mbps: ±600 ps, typical
Edge placement accuracy: Compare[9]	
NI-Digital 17.5 and earlier	
Edge Multiplier = 1x	±500 ps, warranted
NI-Digital 18.0 and later	
Edge Multiplier = 1x	±500 ps, warranted

Edge Multiplier = 2x	Bit rate ≤ 100 Mbps: ±500 ps, typical
Edge Multiplier = 2x	Bit rate ≤ 133 Mbps: ±700 ps, typical
Overall timing accuracy[9]	
NI-Digital 17.5 and earlier	
Edge Multiplier = 1x	±1.5 ns, warranted
NI-Digital 18.0 and later	
Edge Multiplier = 1x	±1.5 ns, warranted
Edge Multiplier = 2x	Bit rate ≤ 200 Mbps: ±1.5 ns, typical
Edge Multiplier = 2x	Bit rate ≤ 266 Mbps: ±1.8 ns, typical
TDR deskew adjustment resolution	39.0625 ps

Driver, Comparator, Load

Driver

Signal type	Single-ended, referenced to the DGS pin when connected. Otherwise referenced to GND.
Programmable levels	V_{IH}, V_{IL}, V_{TERM}
Voltage levels	

Range (V_{IH}, V_{IL}, V_{TERM})	-2 V to 6 V
Minimum swing (V_{IH} minus V_{IL})	400 mV, into a 1 MΩ load
Resolution (V_{IH}, V_{IL}, V_{TERM})	122 µV
Accuracy (V_{IH}, V_{IL}, V_{TERM})	±15 mV, 1 MΩ load, warranted
Maximum DC drive current	±32 mA
Output impedance	50 Ω
Rise/fall time, 20% to 80%	1.2 ns, up to 5 V

Comparator

Signal type	Single-ended, referenced to the DGS pin when connected. Otherwise referenced to GND.
Programmable levels	V_{OH}, V_{OL}
Voltage levels	
Range (V_{OH}, V_{OL})	-2 V to 6 V

Resolution (V_{OH}, V_{OL})	122 µV
Accuracy (V_{OH}, V_{OL})	±25 mV, from -1.5 V to 5.8 V, warranted
Programmable input termination modes	High Z, 50 Ω to V_{TERM}, Active Load
Leakage current	<15 nA, in the High Z termination mode

Active Load

Programmable levels	I_{OH}, I_{OL}
Commutating voltage (V_{COM})	
Range	-2 V to 6 V
Resolution	122 µV
Current levels	
Range	1.5 mA to 24 mA
Resolution	488 nA
Accuracy	1 mA, 3 V over/under drive, typical

PPMU

PPMU Force Voltage

Signal type	Single-ended, referenced to the DGS pin when connected. Otherwise referenced to GND.
Voltage levels	
Range	
NI-Digital 17.5 and earlier	-2 V to 6 V
NI-Digital 18.0 and later	-2 V to 6 V 6 V to 7 V in Extended Voltage Range[10]
Resolution	122 μV
Accuracy	
NI-Digital 17.5 and earlier	±15 mV, 1 MΩ load, from -2 V to 6 V, warranted
NI-Digital 18.0 and later	±15 mV, 1 MΩ load, from -2 V to 6 V, warranted ±50 mV, 1 MΩ load, from 6 V to 7 V, typical[10]

PPMU Measure Voltage

Signal type	Single-ended, referenced to the DGS pin when connected. Otherwise referenced to GND.
Voltage levels	

Range	-2 V to 6 V
Resolution	228 µV
Accuracy	±5 mV, warranted

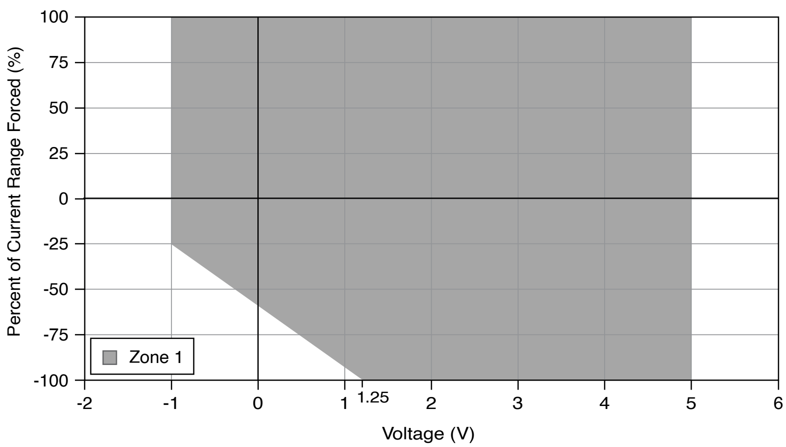
PPMU Force Current

How to Calculate PPMU Force Current Accuracy

Table 1. PPMU Force Current Accuracy

Range	Resolution	Accuracy
±2 µA	60 pA	±1% of range for Zone 1 of Figure 3, warranted
±32 µA	980 pA	
±128 µA	3.9 nA	
±2 mA	60 nA	
±32 mA	980 nA	

Figure 3. Warranted Current Accuracy Zone for PPMU Force Current



Note The boundaries of Zone 1 are inclusive of that zone. The area outside of Zone 1 does not have a warranted spec for PPMU force current accuracy.

1. Specify the desired forced current.
2. Based on the desired forced current, select an appropriate current range from Table 1.
3. Divide the desired forced current from step 1 by the current range from step 2 and multiply by 100 to calculate the Percent of Current Range Forced.
4. Based on the impedance of the load, calculate the voltage required to force the desired current from step 1. Use the following equation: Voltage Required = Desired Current * Load Impedance.
5. Using Figure 2, locate the zone in which the Percent of Current Range Forced calculated in step 3 intersects with the Voltage calculated in step 4. If the intersection is outside of Zone 1, then there are no warranted specs. To get warranted specs, the current range and/or forced current must be adjusted until the intersection is in Zone 1.
6. Based on the zone found in step 5, use Table 1 to calculate the accuracy of the forced current.

PPMU voltage clamps	
Range	-2 V to 6 V
Resolution	122 µV
Accuracy	±100 mV, typical

PPMU Measure Current

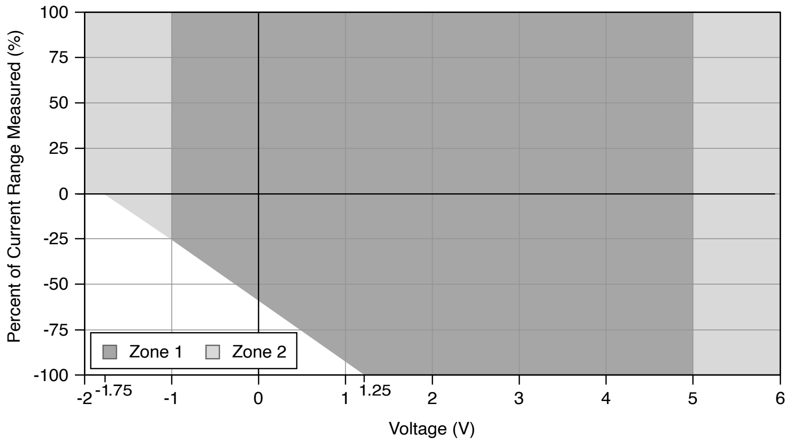
How to Calculate PPMU Measure Current Accuracy

Table 2. PPMU Measure Current Accuracy

Range	Resolution	Accuracy
±2 µA	460 pA	±1% of range for Zone 1 of Figure 4, warranted
±32 µA	7.3 nA	
±128 µA	30 nA	

Range	Resolution	Accuracy
±2 mA	460 nA	±1.5% of range for Zone 2 of Figure 4, warranted
±32 mA	7.3 µA	

Figure 4. Warranted Current Accuracy Zones for PPMU Measure Current



Note The boundaries of Zone 1 are inclusive of that zone. All other boundaries are inclusive of Zone 2. The area outside of Zone 1 and Zone 2 does not have a warranted spec for PPMU measure current accuracy.

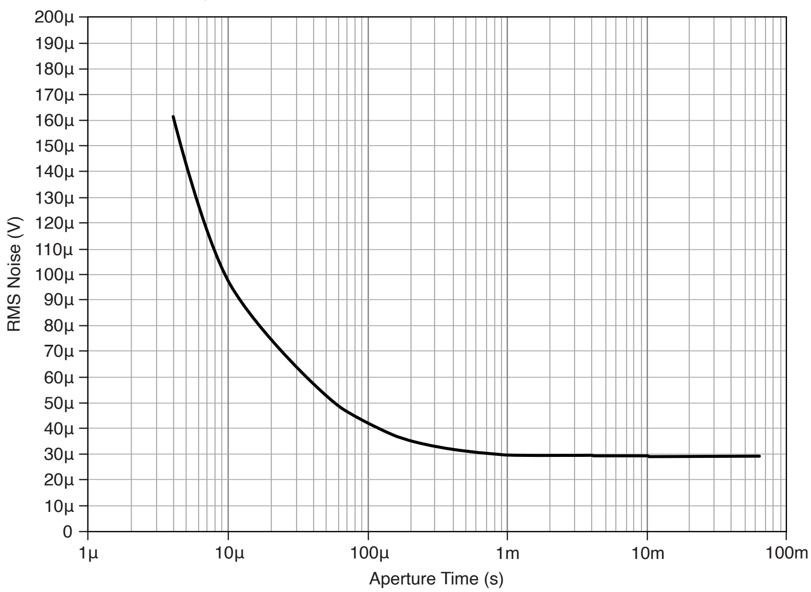
1. Specify the desired measured current.
2. Based on the desired measured current, select an appropriate current range from Table 2.
3. Divide the desired measured current from step 1 by the current range from step 2 and multiply by 100 to calculate the Percent of Current Range Measured.
4. If forcing voltage and then measuring current, Voltage in Figure 3 is equal to the forced voltage. If forcing current and then measuring current, Voltage in Figure 3 is equal to the voltage required to force the desired current based on the impedance of the load. Use the following equation: Voltage Required = Desired Current * Load Impedance.
5. Using Figure 3, locate the zone in which the Percent of Current Range Measured calculated in step 3 intersects with the Voltage calculated in step 4. If the intersection is outside of Zone 1 or Zone 2, then there are no warranted specs. To get warranted specs, the current range and forced current or forced voltage must be adjusted until the intersection is in Zone 1 or Zone 2.

6. Based on the zone found in step 5, use Table 2 to calculate the accuracy of the measured current.

PPMU Programmable Aperture Time

Aperture time	
Minimum	4 µs
Maximum	65 ms
Resolution	4 µs

Figure 5. Voltage Measurement Noise for Given Aperture Times, Typical



Pattern Control

Opcodes

Refer to the following table for supported opcodes. Using matched and failed opcode parameters with multiple PXIe-6570 instruments requires the PXIe-6674T synchronization module. Other uses of flow-control opcodes with multiple PXIe-6570 instruments only require NI-TCLK synchronization.

Category	Supported Opcodes
Flow Control	• `repeat` • `jump` • `jump_if` • `set_loop` • `end_loop` • `exit_loop` • `exit_loop_if` • `call` • `return` • `keep_alive` • `match` • `halt`
Sequencer Flags and Registers	• `set_seqflag` • `clear_seqflag` • `write_reg`
Signal	• `set_signal` • `pulse_signal` • `clear_signal`
Digital Source and Capture	• `capture_start` • `capture` • `capture_stop` • `source_start` • `source` • `source_d_replace`

Note The `source_d_replace` opcode is only available with NI-Digital 18.0 or later.

Pipeline Latencies

Minimum delay between `source_start` opcode and the first `source` opcode or subsequent `source_start` opcode	3 µs
Matched and failed condition pipeline latency	80 cycles

Source and Capture

Digital Source[11]	
Operation modes	Serial and parallel; broadcast and site-unique
Source memory size	32 MB (256 Mbit) total
Maximum waveforms	512

Digital Capture[11]	
Operation modes	Serial and parallel; site-unique
Capture memory size	1 million samples
Maximum waveforms	512

Independent Clock Generators

Note This functionality requires NI-Digital 18.0 or later.

Number of Clock Generators	32 (one per pin)
Clock Period Range	6.25 ns to 40 us (160 MHz to 25 kHz)[12]
Clock Period Resolution	38 fs

Frequency Measurements

Note This functionality requires NI-Digital 17.0 or later.

Frequency counter measure frequency	
Range	5 kHz to 200 MHz, 2.5 ns minimum pulse width
Accuracy	See Calculating Frequency Counter Error

Calculating Frequency Counter Error

Use the following equation to calculate the frequency counter error (ppm).

$$\left(\frac{TB_{err}}{\left(1 - TB_{err}\right)} + \frac{20ns}{\left(MeasurementTime - UnknownClockPeriod\right)}\right) * 1,000,000$$

where

- MeasurementTime is the time, in seconds, over which the frequency counter measurement is configured to run
- UnknownClockPeriod is the time, in seconds, of the period of the signal being measured
- TB_{err} is the error of the Clk100 timebase

Refer to the following table for a few examples of common Clk100 timebase accuracies.

Table 3. TB_{err}

PXI Express Hardware Specification Revision 1.0	PXIe-1085 Chassis	PXIe-6674T Override
100 µ (100 ppm)	25 µ (25 ppm)	80 n (80 ppb)

Example 1: Calculating Error with a PXIe-1085 Chassis

Calculate the error of performing a frequency measurement of a 10 MHz clock (100 ns period) with a 1 ms measurement time using the PXIe-Clk100 provided by the PXIe-1085 chassis as the timebase.

Solution

$$\left(\frac{25\mu}{(1-25\mu)}+\frac{20ns}{(1ms-100ns)}\right)*1,000,000$$

$$=45ppm$$

Example 2: Calculating Error when Overriding with the PXIe-6674T

Calculate the error if you override the PXIe-Clk100 timebase with the PXIe-6674T and increase the measurement time to 10 ms.

Solution

$$\left(\frac{80n}{(1-80n)}+\frac{20ns}{(10ms-100ns)}\right)*1,000,000$$

$$=2ppm$$

Calibration Interval

Recommended calibration interval	1 year

Physical Characteristics

PXIe slots	2
Dimensions	131 mm × 42 mm × 214 mm (5.16 in. × 1.65 in. × 8.43 in.)
Weight	920 g (32.45 oz.)

Power Requirements

The PXIe-6570 draws current from a combination of the 3.3 V and 12 V power rails. The maximum current drawn from each of these rails can vary depending on the PXIe-6570 mode of operation. The total power consumption will not exceed the input power specification.

Input power	68 W
Current Draw	
3.3 V	4.4 A
12 V	4.7 A