APEX WAVES PXIe-6396 PXI Multifunction I-O Module User Manual

APEX WAVES PXIe-6396 PXI Multifunction I-O Module User Manual

This document lists specifications for the PXIe-6396 (18-Bit, 14 MS/s/ch), 2 AO, 24 DIO, PXI Multifunction I/O module.

The PXIe-6396 differs in several ways from other SMIO devices. For more information about special considerations for this device, go to **ni.com/info** and enter the infocode smio14ms.

Contents

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 Typical unless otherwise noted.

Conditions

Specifications are valid at 25 °C unless otherwise noted.

Analog Input

Number of channels: 8 differential
ADC resolution: 18 bits
DNL: No missing codes guaranteed
INL: Refer to the **AI Absolute Accuracy** section.

Sample rate

Maximum with onboard sample clock: 14.29 MS/s
Maximum with external sample clock: 15 MS/s
Minimum: 20 kS/s
Timing resolution: 10 ns
Timing accuracy: 50 ppm of sample rate
Input coupling: DC

Input range: ±1 V, ±2 V, ±5 V, ±10 V

Maximum working voltage for all analog inputs

Positive input (AI+): ±11 V for all ranges, Measurement Category I
Negative input (AI-): ±11 V for all ranges, Measurement Category I

Caution Do not use for measurements within Categories II, III, and IV.

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.

CMRR (DC to 60 Hz): 70 dB
Bandwidth: 1 MHz

Table 1. Total Harmonic Distortion (THD)

Input Range (V)	THD (dB at 100 kHz)
±10	-95
±5	-100
±2	-100
±1	-100

Input impedance

Device on

AI+ to AI GND: >100 GΩ in parallel with 50 pF
AI- to AI GND: >100 GΩ in parallel with 50 pF
Device off
AI+ to AI GND: 10 kΩ
AI- to AI GND: 10 kΩ
Input bias current ±10 pA Crosstalk (at 100 kHz)
Adjacent channels: -90 dB
Non-adjacent channels: -100 dB
Input FIFO size: 4,095 samples shared among channels used, 4,096 samples dedicated per channel
Data transfers: DMA (scatter-gather), programmed I/O (SW timed)

Overvoltage protection for all analog input channels

Device on: ±36 V
Device off: ±15 V
Input current during overvoltage conditions: ±10 mA max/AI pin

Analog Triggers

Number of triggers: 1

Source: AI <0..7>, APFI 0
Functions: Start Trigger, Reference Trigger, Sample Clock, Sample Clock Timebase

Source level

AI <0..7>: ±Full scale
APFI 0: ±10 V
Resolution: 16 bits
Modes: Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering

Bandwidth (-3 dB)

AI <0..7>: 1.5 MHz
APFI: 0 2.5 MHz
Accuracy: ±1% of range

APFI 0 characteristics

Input impedance: 10 kΩ
Coupling: DC
Protection, power on: ±30 V
Protection, power off: ±15 V

AI Absolute Accuracy

Table 2. AI Absolute Accuracy

Nominal Range Positive Full Scale	Nominal Range Negative Full Scale	Residual Gain Error (ppm of Reading)	Offset Tempco (ppm of Range /°C)	Random Noise, σ (µVrms)	Absolute Accuracy at Full Scale (µV)
10	-10	48	34	230	1769
5	-5	55	35	130	929
2	-2	55	37	66	380
1	-1	65	42	50	210

Note For more information about absolute accuracy at full scale, refer to the AI Absolute Accuracy Example section.

Gain tempco: 10 ppm/°C
Reference tempco: 1 ppm/°C
Residual offset error: 20 ppm of range
INL error: 13 ppm of range1

Note Accuracies listed are valid for up to two years from the device external calibration.

AI Absolute Accuracy Equation

Absolute accuracy at full scale on the analog input channels is determined using the following

assumptions

- Temp Change From Last ExternalCal = 10 °C
- SampleRate ≥ 10 MS/s
- Temp Change From LastInternal Cal = 1 °C
- number _of readings = 10,000
- Coverage Factor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows: GainError = 48 ppm + 10 ppm · 1 + 1 ppm · 10 = 68 ppm OffsetError = 20 ppm + 34 ppm ·1 + 92 ppm = 102 ppm Noise Uncertainty = 230 µV · 3 10, 000 = 6.9 µV AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty = 1707 µV

Analog Output

- **Number of channels:** 2
- **DAC resolution:** 16 bits
- **DNL:** ±1 LSB, max
- **Monotonicity:** 16 bit guaranteed
- **Accuracy:** Refer to the AO Absolute Accuracy section.
- **Maximum update rate (simultaneous)**
    1. **Channel**: 3.3 MS/s
    2. **Channels:** 3.3 MS/s
- **Minimum update rate:** No minimum
- **Timing accuracy:** 50 ppm of sample rate
- **Timing resolution:** 10 ns
- **Output range:** ±10 V, ±5 V, ±external reference on APFI 0
- **Output coupling:** DC
- **Output impedance:** 0.4 Ω
- **Output current drive:** ±5 mA
- **Overdrive protection:** ±25 V
- **Overdrive current:** 10 mA
- Power-on state ±5 mV Power-on/off glitch 1.5 V peak for 200 ms Output FIFO size 8,191 samples shared among channels used Data transfers DMA (scatter-gather), programmed I/O AO waveform modes Non-periodic waveform, periodic waveform regeneration mode from onboard FIFO, periodic waveform regeneration from host buffer including dynamic update
- Settling time, full-scale step, 15 ppm (1 LSB) 2 µs Slew rate 20 V/µs Glitch energy at midscale transition, ±10 V range 6 nV · s

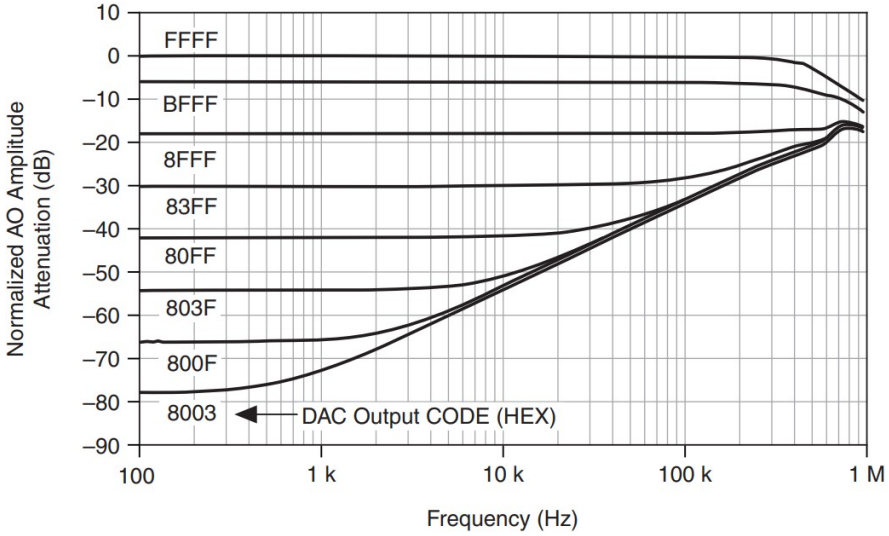
External Reference

APFI 0 characteristics

Input impedance: 10 kΩ
Coupling: DC
Protection, device on: ±30 V
Protection, device off: ± 15 V

Range: ±11 V
Slew rate: ±20 V/µs

Figure 1. Analog Output External Reference Bandwidth



AO Absolute Accuracy

Absolute accuracy at full-scale numbers is valid immediately following self calibration and assumes the device is operating within 10 °C of the last external calibration.

Table 3. AO Absolute Accuracy

Nominal Range Positive Full Scale	Nominal Range Negative Full Scale	Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale (µV)
10	-10	129	17	5	65	1	64	3,256
5	-5	135	8	5	65	1	64	1,616

Note Accuracies listed are valid for up to two years from the device external calibration.

Digital I/O/PFI

Static Characteristics

⚠ **Caution** Stresses beyond those listed under the Input voltage protection specification may cause permanent damage to the device.

Waveform Characteristics (Port 0 Only)

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)

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 bedisposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit **ni.com/environment/weee**.

Documents / Resources

	**APEX WAVES PXIe-6396 PXI Multifunction I-O Module** [pdf] User Manual PXIe-6396 PXI Multifunction I-O Module, PXIe-6396, PXI Multifunction I-O Module, Multifunction I-O Module, I-O Module, Module

References

- NI DAQ Device Custom Cables, Replacement Connectors, and Screws - NI
- NI PXIe-6386 and NI PXIe-6396 Supplementary Information and Caveats - NI
- Engineer Ambitiously - NI
- Engineer Ambitiously - NI
- Product Certifications - NI
- Engineering a Healthy Planet - NI
- Managing Critical Substances - NI
- Product Take-Back Program and Recycling - NI
- Using Info Codes - NI
- Trade Compliance - NI
- National Instruments Patents - NI
- NI Trademarks and Logo Guidelines - NI
- Product Take-Back Program and Recycling - NI
- Engineering a Healthy Planet - NI
- Product Certifications - NI
- PXIe-6396 National Instruments PXI Multifunction I/O Module | Apex Waves