NI 6143 Specifications

This document lists the I/O terminal summary and specifications for the NI PCI/PXI-6143.

For the most current edition of this document, refer to `ni.com/manuals`. Refer to the *DAQ Quick Start Guide* for more information about accessing documents on the NI-DAQ CD.

Note With NI-DAQmx, National Instruments has revised its terminal names so they are easier to understand and more consistent among NI hardware and software products. The revised terminal names used in this document are usually similar to the names they replace. For a complete list of Traditional NI-DAQ terminal names and their NI-DAQmx equivalents, refer to the *Terminal Name Equivalents* table in the *S Series Help*.

Table 1. I/O Terminal Summary

Terminal Name	Terminal Type and Direction	Impedance Input/ Output	Protection (Volts) On/Off	Source (mA at V)	Sink (mA at V)	Rise Time (ns)	Bias
AI <0..7>	AI	100 MΩ in parallel with 10 pF	15/15	—	—	—	—
AI GND	—	—	—	—	—	—	—
D GND	—	—	—	—	—	—	—
+5 V	—	0.1 Ω	Short-circuit to ground	1 A	—	—	—
P0.<0..7>	DIO	—	V_{CC} + 0.5	8 at (V_{CC} – 0.4)	11 at 0.4	1.1	50 kΩ pu
EXTSTROBE*	DO	—	—	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 0 or PFI 0/ (AI START TRIG or AI START)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 1 or PFI 1/ (AI REF TRIG or REF TRIG)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu

Table 1. I/O Terminal Summary (Continued)

Terminal Name	Terminal Type and Direction	Impedance Input/ Output	Protection (Volts) On/Off	Source (mA at V)	Sink (mA at V)	Rise Time (ns)	Bias
PFI 2	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 3 or PFI 3/ (CTR 1 SOURCE or CTR 1 SRC)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 4 or PFI 4/ CTR 1 GATE	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
CTR 1 OUT	DO	—	—	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 5 or PFI 5/ (AO SAMP CLK or AO SAMP)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 6 or PFI 6/ (AO START TRIG or AO START)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 7 or PFI 7/ (AI SAMP CLK or AI SAMP)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 8 or PFI 8/ (CTR 0 SOURCE or CTR 0 SRC)	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
PFI 9 or PFI 9/ CTR 0 GATE	DIO	—	V_{CC} + 0.5	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
CTR 0 OUT	DO	—	—	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu
FREQ OUT or F OUT	DO	—	—	3.5 at (V_{CC} – 0.4)	5 at 0.4	1.5	50 kΩ pu

* Indicates active low

AI = Analog Input DIO = Digital Input/Output pu = pull-up
AO = Analog Output DO = Digital Output

Note: The tolerance on the 50 kΩ pull-up resistors is large. Actual value might range between 17 kΩ and 100 kΩ.

Specifications

The following specifications are typical at 25 °C unless otherwise noted.

Analog Input

Input Characteristics

Number of channels ..... 8 differential

ADC resolution ..... 16 bits, 1 in 65,536

Sampling rate

- Maximum ..... 250 kS/s
- Minimum ..... 0 S/s
- Accuracy ..... ±50 ppm for internal timebase

Input coupling ..... DC

Input range ..... ±5 V

Input impedance

- AI + to AI GND ..... 100 MΩ in parallel with 10 pF
- AI – to AI GND ..... 100 MΩ in parallel with 10 pF

Input bias current ..... ±20 pA typ, ±150 pA max

Input offset current ..... ±3 pA typ, ±20 pA max

Max working voltage for all analog input channels

- Positive input (AI +) ..... ±7 V
- Negative input (AI –) ..... ±7 V

Overvoltage protection
(AI +, AI –) ..... ±15 V

Input current during
overvoltage conditions ..... ±5.7 mA max

Input FIFO size ..... 2,046 samples

Data transfers ..... DMA, interrupts, programmed I/O

DMA mode ..... Scatter-gather

DC Transfer Characteristics

DNL .....±0.8 LSB typ, no missing codes

INL.....±1.5 LSB typ, ±3.0 LSB max

System noise .....0.8 LSB_{rms}

Table 2. NI 6143 Analog Input DC Accuracy Information

Nominal Range at Full Scale (V)	Absolute Accuracy						
	Gain Error (% of Reading)	Offset +INL Error (µV)	Gain Tempco Ext./Int. Cal (%/°C)	Offset Tempco (µV/°C)	Random Noise (μV_{rms})	Absolute Accuracy at Full Scale (mV)	Relative Accuracy (mV)
±5.0	0.05	600	0.0007/0.0003	104	122	3.613	0.0488

Note: Accuracies are valid for measurements following an internal S Series calibration. Averaged numbers assume averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature. NI recommends a one-year calibration interval. The Absolute Accuracy at Full Scale calculations were performed for a maximum range input after one year and 100 points of averaged data.

Dynamic Characteristics

Phase mismatch .....±0.5° at 100 kHz

Crosstalk .....–90 dB at 50 kHz

Bandwidth.....490 kHz

SINAD .....89 dB at 10 kHz

CMRR.....75 dB at 60 Hz

SFDR .....98 dB at 10 kHz

THD .....–96 dBc at 10 kHz

Stability

Recommended warm-up time.....15 min

Onboard Calibration Reference

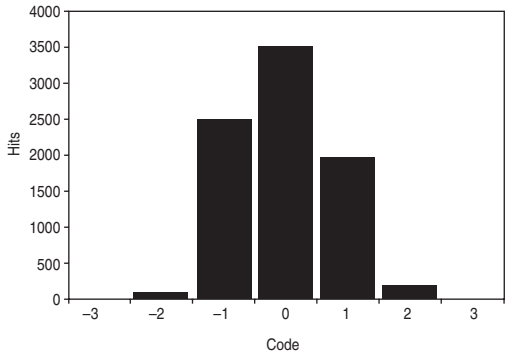
Level .....2.50 V (±2.5 mV)
(actual value stored in EEPROM)

Temperature coefficient.....±7.0 ppm/°C max

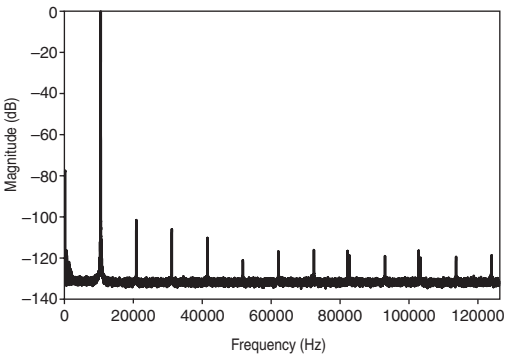
Long-term stability .....±20 ppm/$\sqrt{1{,}000\ \text{h}}$

Typical Performance Graphs

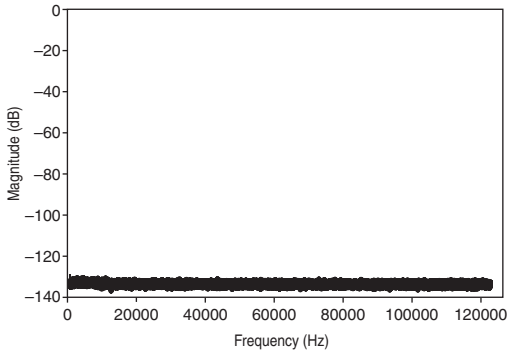
Grounded-Input Histogram



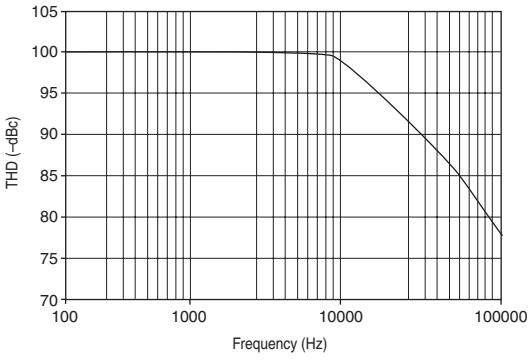
10 kHz, -0.5 dB, 64 k point FFT



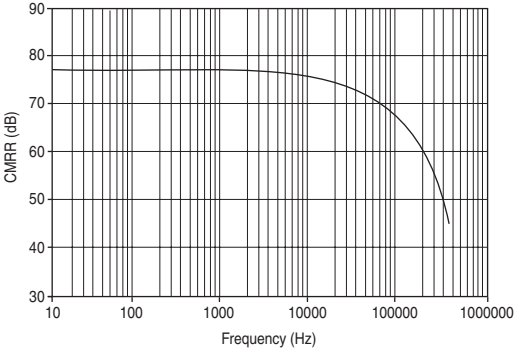
Grounded-input 64 k point FFT



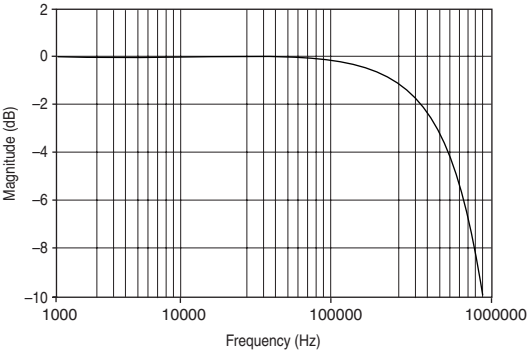
THD



Common-mode Rejection



Bandwidth



Digital I/O

Number of channels.....8 input/output

Compatibility.....TTL/CMOS

Table 3. Digital Logic Levels

Level	Min	Max
Input low voltage	0.0 V	0.8 V
Input high voltage	2.2 V	5.0 V
Input low current (V_{in} = 0 V)	—	–320 µA
Input high current (V_{in} = 5 V)	—	10 µA
Output low voltage (I_{OL} = 24 mA)	—	0.83 V
Output low voltage (I_{OL} = 11 mA)	—	0.4 V
Output low voltage (I_{OL} = –13 mA)	4.1 V	—
Output high voltage (I_{OH} = –8 mA)	4.35 V	—

Power-on state.....Input (high-impedance)

Data transfers.....DMA, interrupts, programmed I/O

Timing I/O

Counter/Timers

Number of channels.....2 up/down counter/timers

Resolution.....24 bits

Compatibility.....TTL/CMOS

Table 4. Digital Logic Levels

Level	Min	Max
Input low voltage	0.0 V	0.8 V
Input high voltage	2.2 V	5.0 V
Output low voltage (I_{OL} = 5 mA)	—	0.4 V
Output high voltage (I_{OH} = –3.5 mA)	4.35 V	—

Base clock frequency ..... 20 MHz

Base clock accuracy ..... ±0.01%

Max source frequency ..... 20 MHz

Min source pulse duration ..... 10 ns, edge-detect mode

Min gate pulse duration ..... 10 ns, edge-detect mode

Data transfers ..... DMA, interrupts, programmed I/O

Frequency Scaler

Number of channels 1

Resolution 4-bit

Compatibility ..... TTL/CMOS

Digital logic levels ..... Refer to Table 4

Base clock frequency ..... 10 MHz, 100 kHz

Base clock accuracy ..... ±0.01%

Digital Trigger

Purpose ..... Start, reference, and pause trigger, sample clock

External sources ..... PFI <0..9>, RTSI <0..6>

Compatibility ..... TTL

Response ..... Rising or falling edge

Pulse width ..... 10 ns min

RTSI Bus (PCI Only)

Trigger lines <0..6> 7

RTSI clock 1

PXI Trigger Bus (PXI Only)

Trigger lines <0..5> 6

Star trigger 1

Clock.....1

Power Requirement

+5 VDC (±5%) .....40 mA

+3.3 VDC (±5%) .....140 mA

+12 VDC (±5%) .....150 mA

–12 VDC (±5%).....80 mA

Power available at I/O connector.....+4.65 to +5.25 VDC at 1 A

Physical

Dimensions
(not including connectors) .....15.5 cm by 10.6 cm
(6.10 in. by 4.17 in.)

I/O connector .....68-pin VHDCI

Environmental

The NI 6143 is intended for indoor use only.

Operating Environment

Ambient temperature range .....0 to 50 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)

Relative humidity range.....10 to 90%, noncondensing (tested in accordance with IEC-60068-2-56)

Altitude .....2,000 m (at 25 °C ambient temperature)

Storage Environment

Ambient temperature range ..... –20 to 70 °C (tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)

Relative humidity range ..... 5 to 95%, noncondensing (tested in accordance with IEC-60068-2-56)

Shock and Vibration

Operational shock ..... 30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800-F.)

Random vibration

- Operating ..... 5 to 500 Hz, 0.3 g_{rms}
- Nonoperating ..... 5 to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800-F, Class 3.)

Note Clean the device with a soft, non-metallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1

Note For UL and other safety certifications, refer to the product label, or visit `ni.com/hardref.nsf`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

Emissions.....EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity .....EN 61326:1997
A2:2001, Table 1

EMC/EMI .....CE, C-Tick, and FCC Part 15
(Class A) Compliant

Note For EMC compliance, you *must* operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety)..... 73/23/EEC

Electromagnetic Compatibility
Directive (EMC)..... 89/336/EEC

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit `ni.com/hardref.nsf`, search by model number or product line, and click the appropriate link in the Certification column.

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