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**PCI-6143**

# 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](http://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 M $\Omega$ in parallel with 10 pF	15/15	—	—	—	—
AI GND	—	—	—	—	—	—	—
D GND	—	—	—	—	—	—	—
+5 V	—	0.1 $\Omega$	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 k $\Omega$ pu
EXTSTROBE*	DO	—	—	3.5 at ( $V_{CC} - 0.4$ )	5 at 0.4	1.5	50 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ pu
CTR 1 OUT	DO	—	—	3.5 at $(V_{CC} - 0.4)$	5 at 0.4	1.5	50 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ 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 k $\Omega$ pu
CTR 0 OUT	DO	—	—	3.5 at $(V_{CC} - 0.4)$	5 at 0.4	1.5	50 k $\Omega$ pu
FREQ OUT or F OUT	DO	—	—	3.5 at $(V_{CC} - 0.4)$	5 at 0.4	1.5	50 k $\Omega$ pu
<p>* Indicates active low</p> <p>AI = Analog Input      DIO = Digital Input/Output      pu = pull-up  AO = Analog Output      DO = Digital Output</p> <p><b>Note:</b> The tolerance on the 50 k<math>\Omega</math> pull-up resistors is large. Actual value might range between 17 k<math>\Omega</math> and 100 k<math>\Omega</math>.</p>							

# Specifications

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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<sub>rms</sub>

**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 <sub>rms</sub> )	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

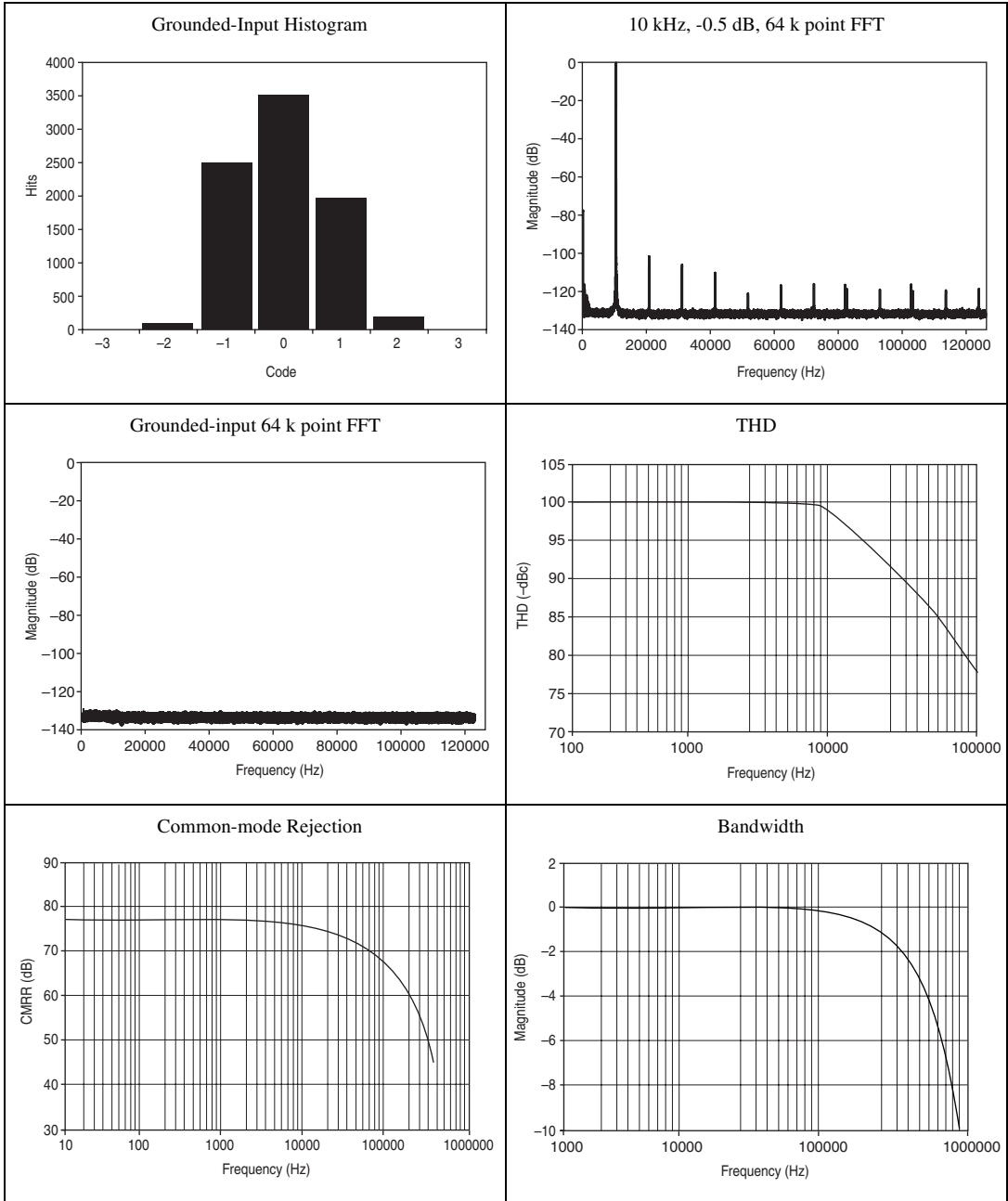
### Onboard Calibration Reference

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

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

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

# Typical Performance Graphs



## 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 $\mu$ A
Input high current ( $V_{in} = 5$ V)	—	10 $\mu$ A
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 .....	$\pm 0.01\%$
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 .....	$\pm 0.01\%$

## 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 ( $\pm 5\%$ ) .....	40 mA
+3.3 VDC ( $\pm 5\%$ ) .....	140 mA
+12 VDC ( $\pm 5\%$ ) .....	150 mA
-12 VDC ( $\pm 5\%$ ).....	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 <sub>rms</sub>
Nonoperating .....	5 to 500 Hz, 2.4 g <sub>rms</sub> (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](http://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](http://ni.com/hardref.nsf), search by model number or product line, and click the appropriate link in the Certification column.

