

NI PCI-6123

16-Bit, 500 kS/s/ch, S Series Simultaneous-Sampling Multifunction DAQ



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NI 6122/6123 Specifications

This document lists the I/O terminal summary and specifications for the NI 6122/6123.

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 M Ω in parallel with 10 pF	35/25	—	—	—	± 16 nA ± 35 nA
AI GND	—	—	—	—	—	—	—
D GND	—	—	—	—	—	—	—
+5 V	—	0.1 Ω 0.45 Ω	Short-circuit to ground	1 A	—	—	—
P0.<0..7>	DIO	—	$V_{CC} + 0.5$	13 at ($V_{CC} - 0.4$)	24 at 0.4	1.1	50 k Ω pu
EXTSTROBE [®]	DO	—	—	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 0/ AI START TRIG	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 1/ AI REF TRIG	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 2	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω 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 3/ CTR 1 SOURCE	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
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 Ω pu
CTR 1 OUT	DO	—	—	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 5	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 6	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 7/ AI SAMP CLK	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
PFI 8/ CTR 0 SOURCE	DIO	—	$V_{CC} + 0.5$	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
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 Ω pu
CTR 0 OUT	DO	—	—	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
FREQ OUT	DO	—	—	3.5 at ($V_{CC} - 0.4$)	5 at 0.4	1.5	50 k Ω pu
AI = Analog Input DIO = Digital Input/Output DO = Digital Output pu = pull-up Note: The tolerance on the 50 k Ω pull-up resistors is large. Actual value might range between 17 k Ω and 100 k Ω .							

Specifications

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

Analog Input

Input Characteristics

Number of channels

NI 6122.....4

NI 6123.....8

Type of ADC

Resolution.....16 bits, 1 in 65,536

Pipeline0

Sampling rate

Maximum	500 kS/s per channel
Minimum	No minimum

Input impedance

AI – to AI GND	100 M Ω in parallel with 10 pF
AI + to AI GND	100 M Ω in parallel with 10 pF

Input bias current ± 2 pA typ, ± 25 pA max

Input offset current..... ± 1 pA typ, ± 10 pA max

Input coupling DC

Max working voltage for all analog input channels

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, or IV.

Overvoltage protection

(AI +, AI –) ± 36 V

Input current during

overvoltage conditions ± 20 mA max

Input FIFO size

NI 6122	16 MS
NI 6123	16 or 32 MS

Data transfers DMA, interrupts,
programmed I/O

DMA mode Scatter-gather

DC Transfer Characteristics

INL ± 2 LSB max

DNL -1 min, 1.5 max,
no missing codes

Absolute Accuracy

Nominal Range at Full Scale (V)	Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Random Noise, σ (μ Vrms)	Absolute Accuracy at Full Scale ¹ (μ V)	Sensitivity ² (μ V)
±10	123	25	5	40	186	62	330	4960	132.0
±5	123	25	5	48	192	62	166	2550	66.4
±2.5	128	25	5	52	229	62	105	1400	42.0
±1.25	128	25	5	58	251	62	60	740	24.0

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty
 GainError = ResidualAGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)
 OffsetError = ResidualAOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error
 NoiseUncertainty = $\frac{\text{RandomNoise} \cdot 3}{\sqrt{100}}$ For a coverage factor of 3 σ and averaging 100 points.

¹ Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:
 TempChangeFromLastExternalCal = 10 °C
 TempChangeFromLastInternalCal = 1 °C
 number_of_readings = 100
 CoverageFactor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:
 GainError = 123 ppm + 25 ppm · 1 + 5 ppm · 10 GainError = 198 ppm
 OffsetError = 40 ppm + 186 ppm · 1 + 62 ppm OffsetError = 288 ppm
 NoiseUncertainty = $\frac{330 \mu\text{V} \cdot 3}{\sqrt{100}}$ NoiseUncertainty = 99 μ V
 AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 4960 μ V

² Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

Dynamic Characteristics

Phase mismatch..... $\pm 0.1^\circ$ at 100 kHz

Table 2. NI 6122/6123 Analog Input Dynamic Characteristics

Input Range	Bandwidth ¹ (kHz)	SFDR Typ ² (dB)	CMRR ³ (dB)	System Noise ⁴ (LSB _{rms})	Crosstalk ⁵ (dB)	THD (dB at 10 kHz)
± 10 V	511	104	70	1.08	-74	-102
± 5 V	511	105	70	1.09	-74	-103
± 2.5 V	505	101	70	1.37	-74	-102
± 1.25 V	505	101	70	1.58	-74	-101
¹ -3 dB frequency for input amplitude at 10% of the input range (-20 dB) ² Measured at 10 kHz with twelfth-order bandpass filter after signal source ³ DC to 60 Hz ⁴ LSB _{rms} , including quantization ⁵ DC to 100 kHz						

Stability

Recommended warm-up time 15 min

Calibration

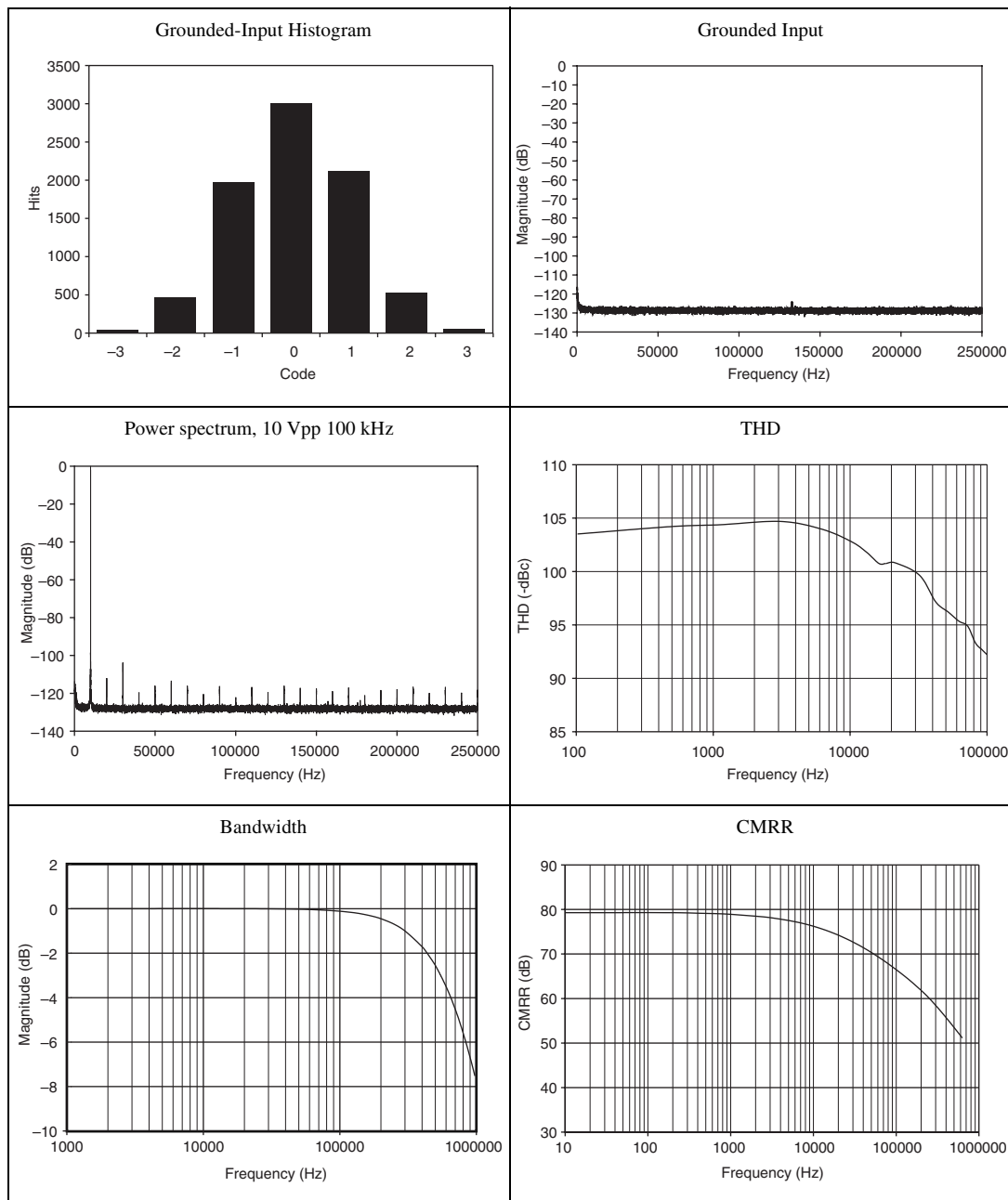
Calibration interval 2 years

Level..... 5.000 V (± 2.5 mV)
(actual value stored in EEPROM)

Temperature coefficient ± 5.0 ppm/ $^\circ\text{C}$ max

Long-term stability..... ± 15 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	2.0 V	5.0 V
Input low current ($V_{in} = 0$ V)	—	–320 μ A
Input high current ($V_{in} = 5$ V)	—	10 μ A
Output low voltage ($I_{OL} = 24$ mA)	—	0.4 V
Output high voltage ($I_{OH} = 13$ mA)	4.35 V	—

Power-on state Input (high-impedance)

Data transfers DMA, interrupts,
programmed I/O

Input buffer 2,044 bytes

Output buffer 2,044 bytes

Transfer rate (1 word = 8 bits) 10 Mwords/s

Timing I/O

Number of channels 2 up/down counter/timers,
1 frequency scaler

Resolution

Counter/timers 24 bits

Frequency scaler 4 bits

Compatibility TTL/CMOS

Base clocks available

Counter/timers 20 MHz, 100 kHz

Frequency scaler 10 MHz, 100 kHz

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
DMA modes	Scatter-gather

Triggers

Analog Trigger

Source	All analog input channels
Level	$\pm$ full-scale
Slope	Positive or negative (software-selectable)
Resolution	8 bits, 1 in 256
Hysteresis	Programmable
Bandwidth (–3 dB)	5 MHz internal/external

Digital Trigger

Compatibility	TTL
Response	Rising or falling edge
Pulse width	10 ns min

RTSI Trigger Lines (PCI Only)

Trigger lines <0..6>	7
RTSI clock	1

PXI Trigger Bus (PXI Only)

Trigger lines <0..6>	7
Star trigger	1

Bus Interface

Type	Master, slave
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Power Requirement

+5 VDC ($\pm 5\%$)

NI 6122 1.03 A

NI 6123 1.9 A

+3.3 V

NI 6122 1.1 A

NI 6123 1.55 A

–12 V

NI 6122 52 mA

NI 6123 81 mA

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

Physical

Dimensions (not including connectors)

NI PCI-6122/6123 31.2×10.6 cm
(12.3×4.2 in.)

NI PXI-6122/6123 16.0×10.0 cm
(6.3×3.9 in.)

I/O connector 68-pin male SCSI-II type

Environmental

Operating temperature 0 to 50 °C

Storage temperature –20 to 70 °C

Humidity 10 to 90% RH, noncondensing

Maximum altitude 2,000 m

Pollution Degree (indoor use only) 2

Safety

The NI 6122/6123 devices are 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 61010-1
- CAN/CSA-C22.2 No. 61010-1



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

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