

NI PCI-5411

High-Speed Arbitrary Waveform Generator



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NI PXI/PCI-5411/5431

Specifications

NI PXI/PCI-5411 High-Speed Arbitrary Waveform Generator

NI PXI/PCI-5431 Video Waveform Generator

This document lists the specifications for the NI PXI/PCI-5411 and the NI PXI/PCI-5431. These specifications are typical at 25 °C unless otherwise stated. The operating temperature range is 0–50 °C.

Analog Output

Number of channels 1

Resolution 12 bits

Maximum update rate 40 MHz

DDS accumulator 32 bits

Frequency range

Waveform Type	NI PXI-5411	NI PXI-5431
Arb	40 MS/s	40 MS/s
PAL-B, STANDARD PAL, N-PAL, Combination N-PAL, SECAM	—	40 MS/s
NTSC/PAL-M	—	40.02797 MS/s
SYNC (TTL)	16 MHz, max	8 MHz, max
Square	1 MHz, max	1 MHz, max
Ramp	1 MHz, max	1 MHz, max
Triangle	1 MHz, max	1 MHz, max

Frequency resolution (DDS mode) 9.31 mHz

Voltage Output

Ranges	± 5 V into a 50 Ω load; ± 10 V into a high-impedance load
Accuracy	± 0.1 dB
Output attenuation	0 to 73 dB
Resolution	0.001 dB steps
Pre-attenuation offset	
Range	± 2.5 V into 50 Ω ¹
Accuracy	± 5 mV
Output coupling	DC
Output impedance	50 Ω or 75 Ω , software selectable
Load impedance	50 Ω or greater
Output enable	Software switchable
Protection	Short-circuit protected
Typical rise/fall time	8 ns (10–90% 0–5 V square wave into 50 W load, filters off)

Sine Spectral Purity

Harmonic products and spurs	
Up to 1 MHz	–60 dBc
Up to 16 MHz	–35 dBc
Phase noise	–105 dBc/Hz at 10 kHz from carrier

Filter Characteristics

Digital	
Type	Half-band interpolating
Selection	Software switchable (enable or disable)
Taps	67
Filter coefficients	Fixed 20-bit

¹ With less than 10 dB of attenuation, signal maximum plus offset (before attenuation) must not exceed ± 5 V (into 50 Ω).

Data interpolating frequency	2x interpolation (up to 80 MS/s)
Pipeline signal delay	26 sampling periods
Analog	
Type	7th-order L-C lowpass filter
Passband ripple	± 2 dB

Waveform Specifications

Memory

Arb mode	
NI 5411	2,000,000 16-bit samples
NI 5431	8,000,000 16-bit samples
DDS mode.....	16,384 16-bit samples

Segment length

Arb mode	256 samples, minimum, multiples of 8 samples
DDS mode.....	16,384 samples, exact

Max segments in waveform memory 5,000 (Arb mode only)

Segment linking (instruction FIFO)

Arb mode	
NI 5411	292 links
NI 5431	1,168 links
DDS mode.....	512 links

Segment looping (Arb mode only)

Count.....	65,536 loops
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Timing I/O

Update clock	Internal, 40 MHz, max
Interval count	2–65,535

Phase locking

External reference sources	
NI PCI-5411/5431	Front panel PLL IN SMB connector, internal, or RTSI clock line

NI PXI-5411/5431	Front panel PLL Ref SMB connector, internal, or PXI_CLK10
Reference clock frequencies	1 MHz, 5–20 MHz in 1 MHz steps
Frequency locking range	
NI 5411	±100 ppm
NI 5431	±500 ppm

Triggers

Digital Trigger

Compatibility	TTL
Response	Rising edge
Pulse width (T_{d1})	20 ns, minimum
Trigger to waveform output (Arb mode) delay (T_{d2})	76 sample clocks plus 38 ns, max
Trigger to waveform output (DDS mode) delay (T_{d2})	28 sample clocks plus 150 ns, max

RTSI

Trigger lines	
NI PCI-5411/5431	7
NI PXI-5411/5431	7
Clock lines	
NI PCI-5411/5431	1
NI PXI-5411/5431	Not applicable

Bus Interface

Type	Slave
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Operational Modes

Type	Single, continuous, burst, stepped
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Other Outputs

SYNC Out

Level..... TTL

Duty cycle 20–80%, software controllable

Marker Output

Types..... TTL

Location User defined, one per stage

Pulse width (T_{d4}) 8 sample clock periods

Arb output delay from marker (T_{d3})..... 50 ns, max

Digital Pattern Output

Sample rate..... 40 MHz, max

Resolution 16 bits

Sample clock logic TTL

Clock pulse HIGH time..... 25 ns, fixed
(for clock interval counts >1)

PCLK to pattern data

output time (T_{co})..... 1 ns, max

Digital pattern logic TTL

Logic level output ratings for SYNC, marker, digital pattern,
and sample clock outputs

Type	Min	Max
V_{OH}	3.0 V	—
V_{OL}	—	0.7 V
I_{OH}	—	1.0 mA
I_{OL}	—	1.0 mA
V_{OH} = voltage output for logic level 1 V_{OL} = voltage output for logic level 0 I_{OH} = current output for logic level 1 I_{OL} = current output for logic level 0		

External PLL Reference Input

Frequency	1 MHz or 5–20 MHz in 1 MHz steps
Amplitude	$1\text{ V}_{\text{pk-pk}} \leq \text{level} \leq 5\text{ V}_{\text{pk-pk}}$

Internal Clock

Frequency	40 MHz
Initial accuracy	$\pm 5\text{ ppm}$
Temperature stability (0 to 50 °C)	$\pm 25\text{ ppm}$
Aging (1 year)	$\pm 5\text{ ppm}$

External Clock Reference Input

Frequency	40 MHz, max
Amplitude	TTL

Mechanical

Connectors	
ARB/Video (output)	SMB/BNC
SYNC (output)	SMB/BNC
PLL reference (input)	SMB
Digital I/O (digital pattern out, marker out, external trigger in)	50-pin digital, SMB (for PXI)
Size	1 slot
Power requirements	5 V, 3.5 A, max; 12 V, 125 mA

Safety

This product meets the requirements of the following standards for 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, 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/certification, search by model number or product line, and click the appropriate link in the Certification column.

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