Analog Discovery Pro (ADP3450/ADP3250) Specifications

These specifications are valid following 30 minutes of warm-up and are typical at 25 °C unless otherwise noted.

Mixed Signal Oscilloscope

Analog Input Channels

Supports the Oscilloscope, Voltmeter, Data Logger, Spectrum Analyzer, Network Analyzer, Impedance Analyzer, and Script Editor instruments.

Vertical System

Number of Channels	**ADP3450:** 4 **ADP3250:** 2 *There are no other specification differences between the ADP3450 and ADP3250.*
Input Type	Single-ended
Connector Type	Front panel BNC
Input Coupling	AC, DC
Bandwidth (-3dB)	≥55 MHz [1]
Hardware Bandwidth Limit (-3dB)	20 MHz, can be enabled or disabled in software per channel
Resolution	14 bits
Software-Enhanced Vertical Resolution	16 bits at ≤25 MS/s (at default 100 MS/s sample rate)
Input Impedance	1 MΩ ‖ 15 pF
AC Coupling Cut-off Frequency	12 Hz at -3 dB
Absolute Resolution	0.125 mV (scale ≤ 200 mV/div) 3.05 mV (scale > 200 mV/div)
Accuracy (DC to 1 kHz, Integrative measurements)[2]	±10 mV ± 0.5% (scale ≤ 200 mV/div, VinCM = 0 V) ±100 mV ± 0.5% (scale > 200 mV/div, VinCM = 0 V)
Input Range	±25 V with respect to ground (50 V peak-to-peak)
Vertical Sensitivity (range)	500 µV/div to 5 V/div (10 ranges)
Acquisition Modes	Sample, peak detect, averaging, oversampling[3]
Overvoltage Protection	±50 V DC or ±30 V RMS

DC Offset Range

Range	Full Scale	Offset	Offset Accuracy
Low range (≤200 mV/div)	2 V peak-to-peak	±1 V	±25 mV
High range (>200 mV/div)	50 V peak-to-peak	±25 V	±625 mV

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[1] A probe with the appropriate frequency response is required to reach the specified oscilloscope bandwidth.

[2] Average, High, Low, Middle, Amplitude, AC RMS, DC RMS are integrative measurements; they include average mechanisms which reduce the effect of noise and short pulses (overshoots, undershoots). Max, Min, Pk2Pk, Overshoot, RiseOvershoot, FallOvershoot are sample based measurements, affected by noise and short pulses (overshoots, undershoots).

[3] With steady periodic signals.

Horizontal System

Maximum Sample Rate	Up to 125 MS/s per channel
Fine System Frequency Adjustment	50 MHz to 125 MHz[1]
Maximum Oversampling Rate	Up to 0.5 GS/s per channel
Buffer Size	Up to 32 MS[2] per channel in the default Standard mode configuration.[3]

Note: Acquisitions are made simultaneously on all enabled channels in all modes.
Note: Memory sizes, including buffer sizes, specified in units like kS and MS, are rounded from equivalent binary power units, such as MiS. For example, a listed 64 MS is rounded from 64 MiS, which is 67,108,864 samples.

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[1] Adjustable through the WaveForms Device Options. Shared with the Analog Output and Digital I/O.
[2] Up to 128 MS when a single channel is used.
[3] Buffer size is limited to 32,768 samples when Linux mode is used.

Digital Channels

Supports the Logic Analyzer, Pattern Generator, Static I/O, Protocol Analyzer, and Script Editor instruments.

Vertical System

Number of Channels	16
Connector	Header 100 mil 2×12 MTE
Input Voltage	0 V to 3.3 V (5 V tolerant)
Input Current	≤50 μA
Input Threshold	0 V to 2.0 V, dependent on adjustable supply rail
Input Type	LVCMOS (1.2 V to 3.3 V, 5 V tolerant), dependent on adjustable supply rail
Input Logic Level	Input Low Voltage, VIL Min 0 V Max 0.8 V Input High Voltage, VIH Min 2.0 V Max 5.25 V
Output Type	Adjustable 1.2 V to 3.3 V set through adjustable supply rail LVCMOS (3.3 V, 8 mA)
Output Logic Level	Output Low Voltage, VOL sinking 8 mA Min 0 V Max 0.4 V Output Max Voltage, VOH sourcing 8 mA Min 2.4 V Max 3.456 V
DIO Channel Pull Resistors	10 kΩ, pull-up to adjustable supply rail
Function Control	Individually programmable as Digital I/O, Logic Analyzer or Pattern Generator
Protocols	SPI, I2C, UART, CAN, I2S, 1-Wire, HDMI CEC, Manchester codes, custom .[1]
Pattern Generator	Constant, clock, pulse, random, number, Binary counter, Gray counter, Johnson counter, Decimal counter, walking 0/1, custom
Custom Patterns File	Import and export custom data as *.csv, *.txt or *.tdms file
Direction Control	Input or output, individually selectable
Channel-to-Channel Skew	2 ns, typical
Overvoltage Protection	Short-circuit to ground, ±15 V

Note: *Characteristics of the logic standard used for digital input/output can be configured within the Power Supplies instrument. For the digital power supply's specifications, see the Digital Power Supply section, below.*

Horizontal System

	Default	Maximum
Sampling Rate (real-time sampling)	100 MS/s per channel	125 MS/s per channel

Logic Analyzer Buffer Memory	32 MS samples per channel in Standard Mode

Pattern Generator Buffer Memory	32,768 samples per channel

Triggering

Trigger Sources	Oscilloscope analog channels, Function generator start, Digital I/O lines, External triggers (TRIG1/TRIG2), Manual
Trigger Modes	None, Auto, Manual (Forced Trigger), Single
Analog Trigger	Edge, pulse, transition, condition, level, hysteresis, hold-off
Digital Trigger	Edge, level, pattern, glitch
Analog/Oscilloscope Trigger Resolution	2 ns
Digital/Logic Analyzer Trigger Resolution	8 ns

External Triggers (TRIG1/TRIG2)

Number of Channels	2
Trigger Type	Digital
External Trigger Connector	Rear panel BNC
Input Voltage	3.3 V, 5 V tolerant
Input Current	≤50 µA
Input Threshold	0 V to 2.0 V
Input Type	LVCMOS (3.3 V, 5 V tolerant)
Input Logic Level	Input low voltage, VIL Min 0 V Max 0.8 V Input high voltage, VIH Min 2.0 V Max 5.25 V
Output Type	LVCMOS (3.3 V, 8 mA)

Output Logic Level	Output low voltage, VOL
	Min 0 V
	Max 0.4 V
	Output high voltage, VOH
	Min 2.4 V
	Max 3.465 V
Channel Pull Resistors	1 MΩ pull-down
Direction Control	Individually programmable as input or output
Overvoltage Protection	Short-circuit to ground, ±15 V

Arbitrary Waveform Generator (Wavegen)

Supports the Waveform Generator, Network Analyzer, Impedance Analyzer, and Script Editor instruments.

Number of Channels	2
Output Type	Single-ended
Connector Type	Front panel BNC
Update Rate	100 MS/s by default, 125 MS/s maximum
Resolution	14 bits
Output Impedance	50 Ω
Bandwidth (-3 dB)	>15 MHz
Standard Functions	Sine, square, triangle, sawtooth, ramp up, ramp down, DC voltage, noise, trapezium, others
Advanced Waveforms	Sweep, modulation (AM, FM), math, play mode, custom
Sweep Modes	Frequency and Amplitude. Up and down with selectable start/stop frequencies and settable time increments
Custom Waveform Files Supported	Import files *.csv, *.txt, *.mp3, *.wav, *.wmv & *.avi, export as image, or as raw data in *.csv, *.txt or *.tdms formats
Output Frequency Resolution	1 µHz
Output Voltage Range	±5 V with open circuit or high-Z load.
	±3.5 V at maximum current.
DC Offset Range	±5 V
DC Current Drive	30 mA maximum
Slew Rate	200 V/us (5 V step)
Absolute Resolution	150 µV ($\lvert$Vout$\rvert$ ≤ 1 V)
	670 µV ($\lvert$Vout$\rvert$ > 1 V)
Accuracy	±10 mV ± 0.5% ($\lvert$Vout$\rvert$ ≤ 1 V)
	±25 mV ± 0.5% ($\lvert$Vout$\rvert$ > 1 V)
Buffer Size	32,768 samples per channel, 32 MS per channel in Play configuration
Power-Off State	High Impedance
Overvoltage Protection	Short-circuit to ground, ±15 V

Output Range

Range Setting	AC Amplitude Range	DC Offset Range	Resolution	Amplitude Error	DC Offset Error	Total Output Range
High range	±5 V	±5 V	670 µV/LSB	±0.5%	±50 mV	±5 V
Low range	±1 V	±5 V	150 µV/LSB	±0.5%	±10 mV	±5 V

Note: *Shares external triggers with Mixed Signal Oscilloscope.*

Pattern Generator

Shares digital input/output channels with Mixed Signal Oscilloscope: See the Digital Channels specifications.

Features

Spectrum Analyzer

Frequency Range	0 Hz to 50 MHz
Display Modes	Magnitude, average, peak hold, min hold, count
Y Axis	Logarithmic (dBṼ, dBu, dBm) or linear (volts)
X Axis	Linear or Logarithmic
Windowing Functions	Rectangular, Triangular, Hamming, Hann, Cosine, Blackman-Harris, Flat Top, Kaiser

Network Analyzer

Frequency Range	20 µHz up to one-quarter of the system clock frequency (25 MHz by default) [1]
Display Modes	Magnitude, Phase
Y Axis	Linear or Logarithmic
X Axis	Linear or Logarithmic
Plots	Time, FFT, Nichols, Nyquist

[1] Results may be limited by the analog input and output bandwidth of the hardware.

Protocol Analyzer

Shares digital input/output channels with Mixed Signal Oscilloscope: See the Digital Channels specifications.

Protocols	UART, SPI, I2C, CAN, CEC, SWD AVR

Math Channels

Operations	Addition "+", Subtraction "-", Multiplication "*", Division "/", Remainder "%"
Brackets	Parenthesis "()", Square "[]"
Constants	Exp, Ln, Log, Pi
Functions	Logarithm, power, minimum, maximum, square root, sine, cos, tan, arccos, arctan, arctan2, absolute value, round, floor, ceil
Operands	All analog and digital input channels, reference waveforms, time, constants, Pi

Automatic Measurements (Analog Channels Only)

Oscilloscope Mode	DC to maximum bandwidth of scope
Spectrum Mode	Magnitude, average, peak hold, min hold, count
Statistics	Logarithmic (dBṼ, dBu, dBm) or linear (volts)

Digital Power Supply

Supported by the Power Supplies and Script Editor instruments. Contains logic standard settings for the digital input/output channels. See the Digital Channels specifications.

Number of Channels	1
Voltage Range	1.2 V to 3.3 V
Current Output	300 mA
Connector Type	2 pins included in the Digital 100 mil 2×12 MTE Header

Connectivity

USB Interfaces

Device to Computer Interface	USB 2.0 Hi-Speed, Type B
USB 2.0 Host Ports	4 USB 2.0 Hi-Speed Type A (*see below)

* USB Host Port Current Limits

	Minimum	Typical	Maximum
Left Ports (Indicated by circle on enclosure)	0.9 A	1.06 A	1.22 A
Right Ports	0.51 A	0.61 A	0.68 A

Compatible Wi-Fi Dongles

- TL-WN823N (RTL8192CU chipset)
- TL-WN823N (RTL8192EU chipset)
- TL-WN722N v1 (AR9002U chipset)
- Cudy WU1300 (RTL8812BU chipset)
- Cudy WU1300S (RTL8812BU chipset) - 2.4 GHz is unsupported
- Alpha AWUS036ACH (RTL8812AU chipset) - must be connected to the circled USB ports
- Panda PAU05
- Panda PAU09

Note: *Digilent recommends the use of the bottom left USB host port for connection to Wi-Fi dongles.*

Ethernet Interface

Network Interface	1000 Base-TX, full-duplex 100 Base-TX, full-duplex 100 Base-TX, half-duplex 10 Base-T, full-duplex 10 Base-T, half-duplex
Communication Rates	10/100/1000 Mbps, auto-negotiated
Connector Type	RJ-45

Note: *MAC address located on a sticker next to the Ethernet port.*

Power Requirements

The ADP3450 and ADP3250 require an auxiliary power supply.

Power Supply Voltage	19 V
Power Supply Current	3.4 A
Power Consumption	45 W maximum
Barrel Connector Size	5.5 mm x 1.65 mm

Physical Characteristics

Dimensions	23.40 cm x 19.40 cm x 3.81 cm (9.2 in x 7.6 in x 1.5 in)
Weight	450 g

Environmental

Operating Temperature	0 °C to 40 °C (32 °F to 104 °F)
Storage Temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Operating Humidity	10% to 80% RH non-condensing
Storage Humidity	5% to 95% RH non-condensing
Cooling	Convection-cooled. Ensure the ventilation holes are not obstructed. [1] [2]
Pollution Degree	2
Maximum Altitude	2,000 m

Indoor use only

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[1] The side vents are sufficient cooling for normal operation.
[2] The device's fold-out feet can be used to allow for circulation through ventilation holes located on the bottom of the device.

Safety

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

Emissions

- EN 61326-1:2013 (IEC 61326-1:2012), Class A
- IEC CISPR 11: 2015 / A1: 2016 (Ed 6.1)

Immunity

- EN 61326-1:2013 (IEC 61326-1:2012), Basic
- EN 61000-3-2: 2014
- EN 61000-3-3: 2013
- IEC 61000-4-2: 2008
- IEC 61000-4-3: 2006 / A1: 2007 / A2: 2010
- IEC 61000-4-4: 2012
- IEC 61000-4-5: 2014 / A1: 2017
- IEC 61000-4-6: 2013 / COR1: 2015
- IEC 61000-4-8: 2009
- IEC 61000-4-11: 2004 / A1: 2017

CE Compliance

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)
- RoHS Directive 2011/65/EU as amended by Directive (EU) 2015/863