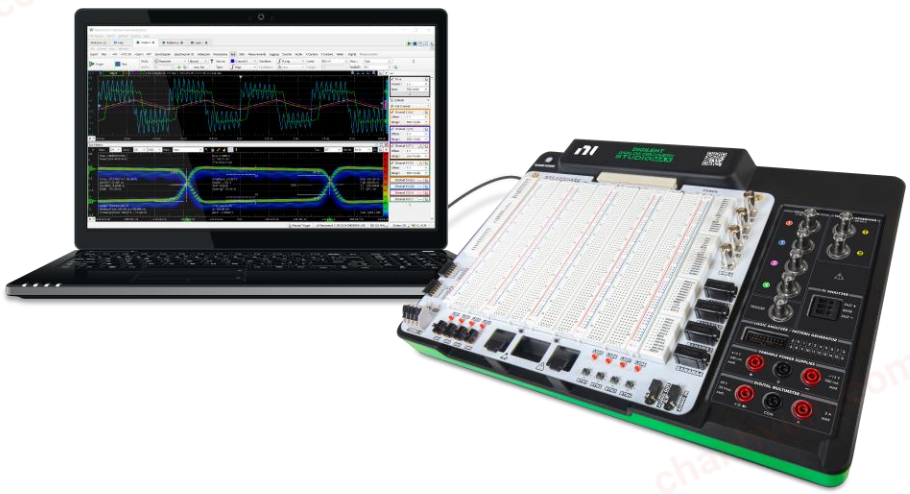
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Analog Discovery Studio Max Datasheet

Engineering & Learning Via Inspired Students



Highlighted Features

- Four oscilloscope channels with 50 MHz bandwidth
- Two arbitrary waveform generators
- Dedicated Canvas boards for prototyping, laboratory, and learning environments
- Six power supplies, variable and static
- Up to 24 digital I/O channels
- Built-in digital multimeter
- USB connection to host computer

Overview

The Analog Discovery Studio Max (ADS Max) is a comprehensive electronics laboratory solution designed for academic instruction and hands-on learning. Equipped with 14 built-in instruments, supporting everything from a multimeter and bode plots to digital protocol generation and spectral analysis, the ADS Max is ideal for circuit design, signal analysis, and embedded systems coursework. With a variety of removable and curriculum tailored Canvas boards to enhance its functionality, the ADS Max enables dynamic, hands-on experiences in both classroom and remote learning environments.

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1 Features

Analog Inputs

- Four BNC input channels with 14-bit resolution and ±25 V input range
- 50 MHz bandwidth, 100 MS/s per channel

Analog Output

- Two BNC output channels with 14-bit resolution, ±5 V output range
- 15 MHz bandwidth, 100 MS/s per channel

Digital I/O

- 16 dynamically configurable digital input/output channels
- 3.3 V CMOS
- 100 MS/s per channel

Power Supplies

- Two programmable power supplies: 0.5 V to 15 V and -0.5 V to -15 V; up to 500 mA per channel
- Four fixed power supplies: 15 V (500 mA), -15V (500 mA), 5 V (2 A), and 3.3 V (310 mA)

Additional Features

- Supports swappable Canvases for multiple convenient prototyping and ready-made solutions
- An integrated USB hub to directly power, interface with, and debug downstream systems
- Advanced triggering and cross triggering between instruments and devices

Software Support

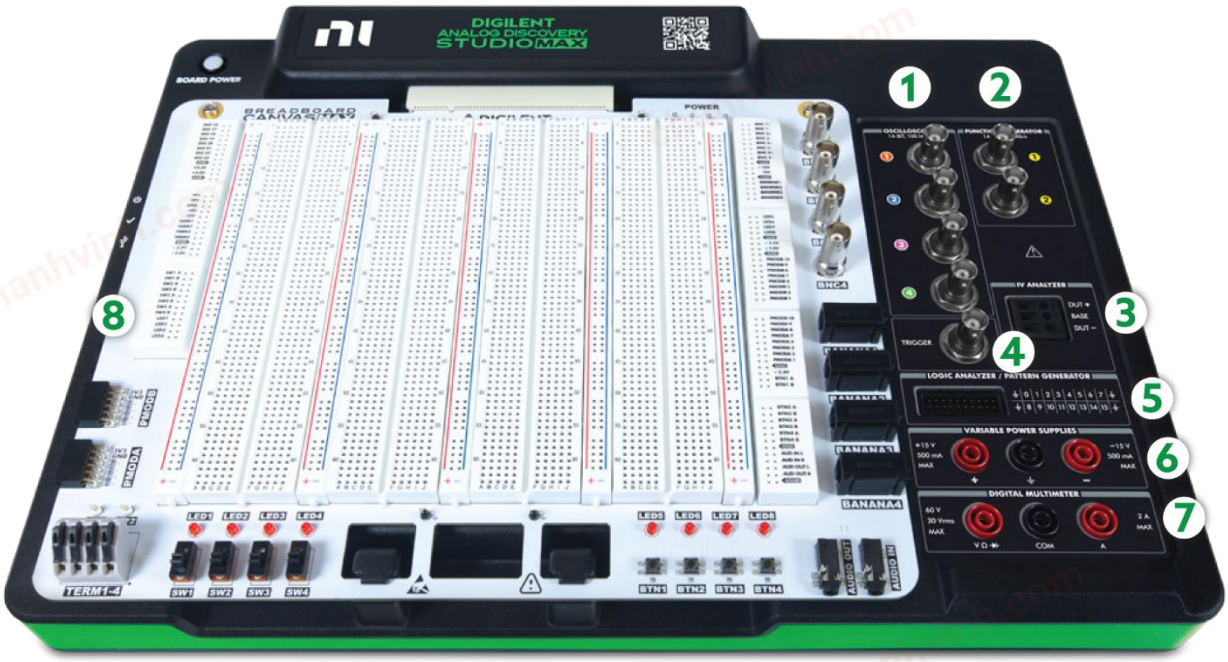
- WaveForms, Digilent's free software application for Windows, Mac, and Linux
- WaveForms SDK for custom applications and scripting through C/C++, Python, C#, Visual Basic
- LabVIEW WaveForms Toolkit

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Callout Diagrams

Analog Discovery Studio Max



1. Oscilloscope
2. Waveform Generator
3. IV Analyzer
4. Trigger
5. Logic Analyzer and Pattern Generator
6. Variable Power Supplies
7. Digital Multimeter
8. Included Analog Discovery Studio Canvas Max

Additional Software Instruments

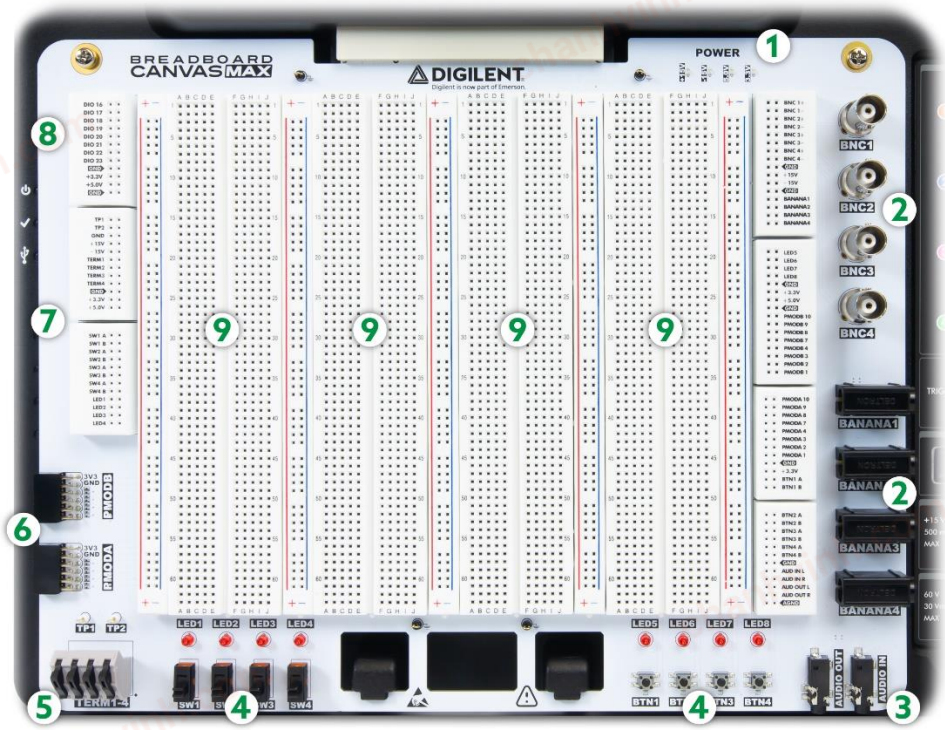
a. Network Analyzer
b. Spectrum Analyzer
c. Voltmeter
d. Impedance Analyzer
e. Data Logger
f. Protocol Analyzer
g. Virtual I/O

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Analog Discovery Studio Canvas Max

The Analog Discovery Studio Canvas Max adds a large breadboard surface, access to Analog Discovery Studio Max static power supplies, and a variety of common devices like switches, buttons, and LEDs to the Analog Discovery Studio Max.



1. Static Power Supply LED indicators.
2. BNC and Banana jacks.
3. Audio In and Out Connectors
4. User buttons, switches, and LEDs.
5. Terminal block and Test Point headers.
6. Two Pmod Host ports.
7. Breadboard contact points for all of the surrounding user I/O.
8. Eight additional DIO pins for the Logic Analyzer and Pattern Generator.
9. Four full sized breadboards.

Additional Canvas Add-ons

A variety of additional Canvas boards created by our Partners that provide curated engineering education learning, design, and system integration experiences are available for the Analog Discovery Studio Max. The complete list of Canvas boards is available to review on Digilent's Reference site at https://digilent.com/reference/test-and-measurement/analog-discovery-studio-max/canvases/start.

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2 WaveForms Software

Digilent's free WaveForms software offers a unified device experience across all our Test and Measurement devices, enabling use of all hardware features and instruments. It features a friendly user interface that has the feel of traditional benchtop devices. WaveForms makes it easy to acquire, visualize, store, analyze, produce, and reuse both analog and digital signals simultaneously.

For even more customization potential, the free WaveForms Software Development Kit (SDK) can be used to create custom applications and scripts to control the T&M device in Python, C, and additional languages.

WaveForms is Windows, Mac, and Linux compatible.

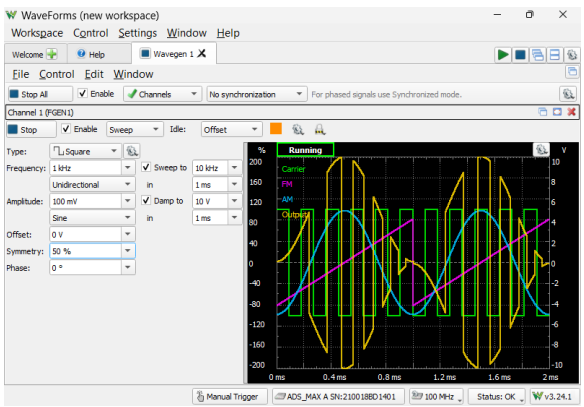
2.1 Oscilloscope

The Oscilloscope instrument captures analog input data via the analog input scope channels. When this instrument is used, the Analog Discovery Studio Max's analog input channels act as a four channel, 14-bit, 50 MHz bandwidth, 100 MS/s oscilloscope. Multiple sample and triggering modes are supported.



2.2 Waveform Generator

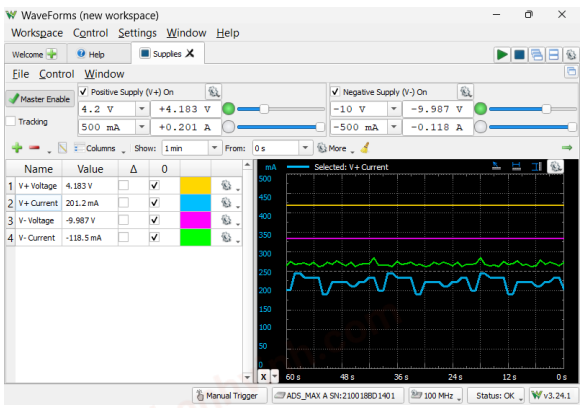
The Waveform Generator instrument can output a pair of analog voltage waveforms. The instrument supports everything from simple waveforms like Sine and Triangle waves, up to more complicated functions like AM and FM modulation. Custom sets of samples can be defined by the user in applications like Excel and imported to WaveForms.



2.3 Power Supplies

The Analog Discovery Studio Max has two variable power supply rails that can be used to power circuits under test at up to 500 mA per channel. These rails can be set to voltage levels between 1 V to 15 V and -1 V to -15 V.

Four fixed +15 V, -15 V, 5 V, and 3.3 V rails are also available, but are not controlled from software.

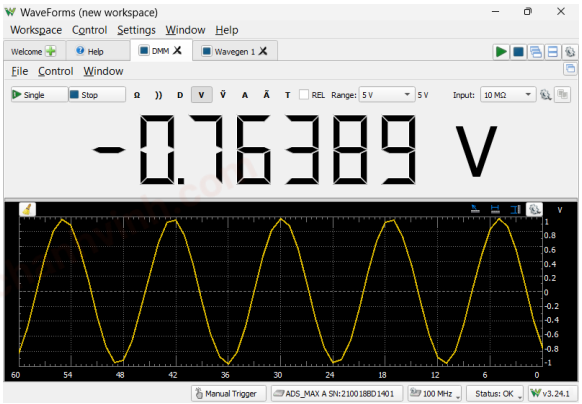


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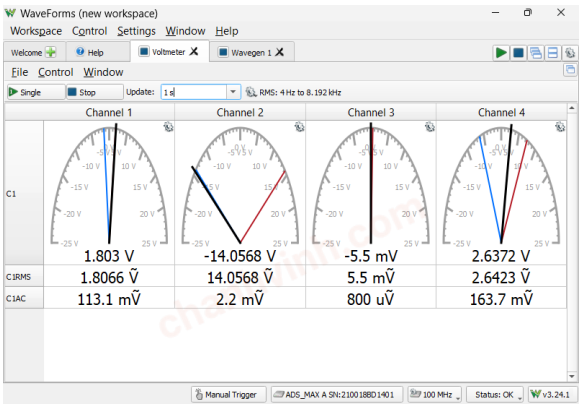
2.4 Digital Multimeter

The Analog Discovery Studio Max has a pair of Digital Multimeter inputs, letting users take a variety of individual measurements including voltage, current, resistance, diode, and continuity measurements. Each measurement also supports a tare system to easily eliminate unwanted offset.



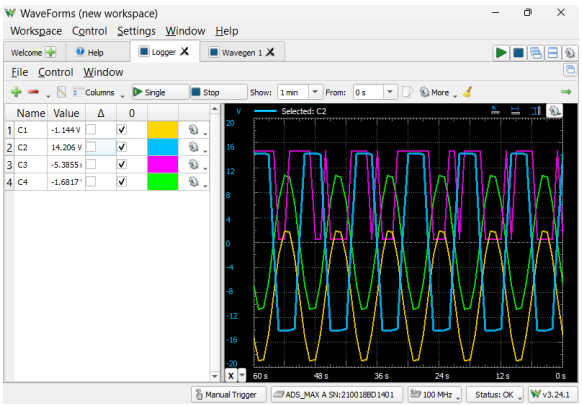
2.5 Voltmeter

The Analog Discovery Studio Max's four oscilloscope channels can be used with WaveForms' Voltmeter instrument to act as a simple voltmeter. DC voltages, AC RMS voltages, and True RMS voltages can be viewed for each of the four Scope channels.



2.6 Data Logger

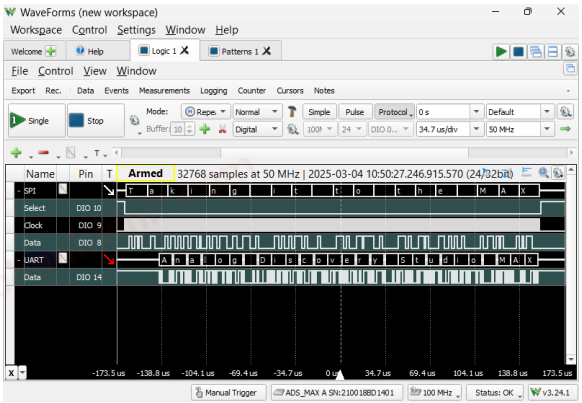
The Data Logger instrument can capture large buffers of analog input data on the Scope pins. The Data Logger can capture buffers of data at update rates of up to 1000 samples per second. The maximum duration of a log is dependent on the update rate, but at the extreme, can run for over a thousand hours.



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2.7 Logic Analyzer

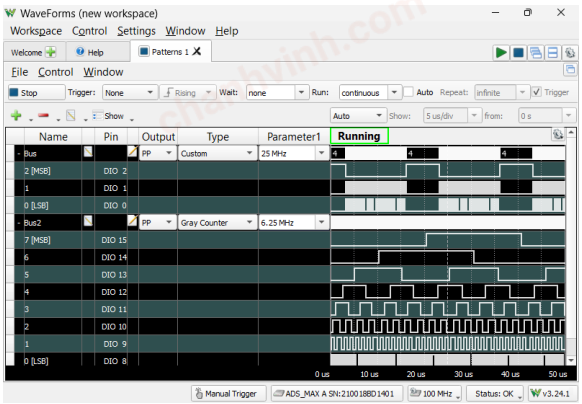


With the Logic Analyzer, the 16 digital input/output channels are configured to capture high/low logic states. These 3.3 V channels are tolerant to voltages of up to 5 V. Certain Canvases can expose 8 additional DIO channels for up to 24 channels in total.

Individual input/output channels can be grouped as buses and protocols. Protocol groups can be used to view the decoded contents of packets of many common communications protocols, including SPI, I2C, UART, CAN, and I2S.

Signal states, decoded bus values, and decoded protocols can be used to trigger a Logic Analyzer capture. Protocol triggers include protocol-specific events, like start-of-transmission, end-of-transmission, or packet contents matching a user-specified value.

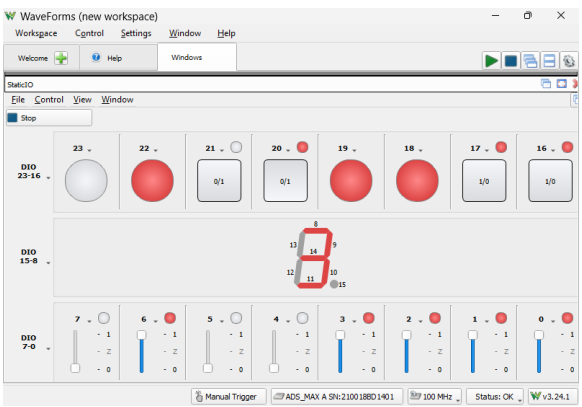
2.8 Pattern Generator



The Pattern Generator can generate logic signal sequences on the digital input/output pins. The pins can be configured to be push/pull, open drain, open source, or three-state logic. Sample rates can go as high as 100 MS/s.

Various patterns can be generated, including clocks, random signals, multiple counter types, and fully custom digital data. ROM logic can map digital input pins to digital outputs, using user-defined truth tables.

2.9 Static I/O



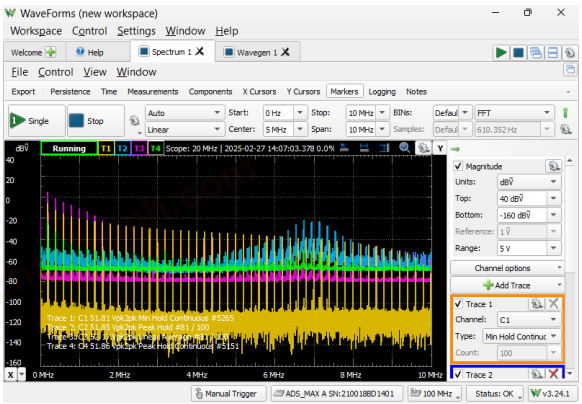
The Static I/O instrument can emulate a variety of user input/output devices on the digital input/output pins. Virtual LEDs, buttons, switches, sliders, and displays can be assigned to specific digital I/O pins and interacted with within the WaveForms user interface.

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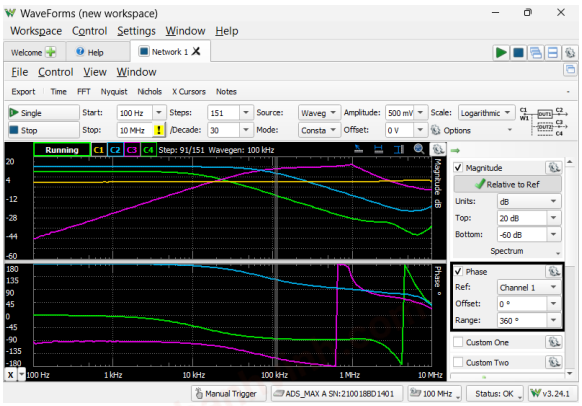
2.10 Spectrum Analyzer

The Spectrum Analyzer instrument is used to view the power of frequency-domain components of analog signals captured on the analog input channels. Cursors and automatic measurements include noise floor, SFDR, SNR, THD and more.



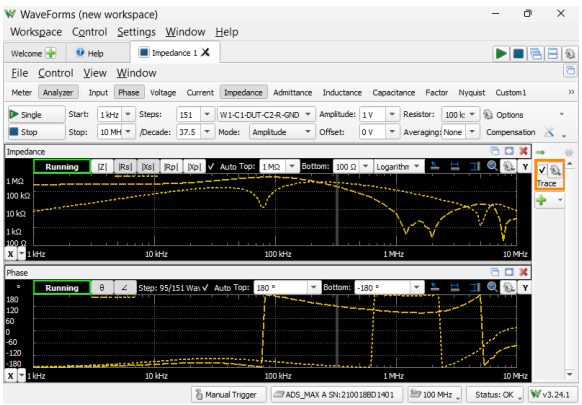
2.11 Network Analyzer

The Network Analyzer instrument can be used to view the amplitude and phase response of a circuit under test. Bode, Nichols, and Nyquist plots can also be viewed with this instrument. The Network Analyzer instrument uses the analog output and analog input channels of the Analog Discovery Studio Max to probe a test circuit, by generating a frequency sweep and measuring the circuit's response. The Network Analyzer can be configured to use an external signal to provide input to the circuit under test, rather than using the analog output channels.



2.12 Impedance Analyzer

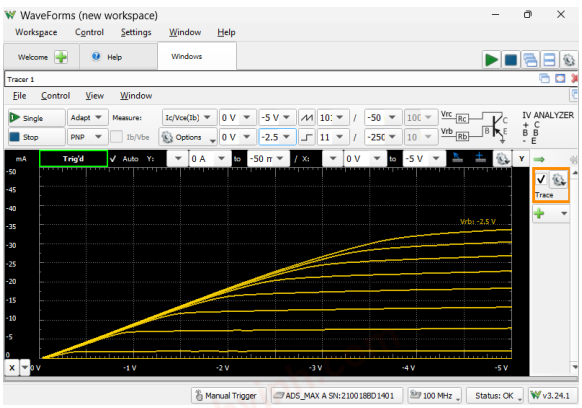
The Impedance Analyzer instrument is used to view a wide variety of frequency response characteristics of a circuit under test. Input, Phase, Voltage, Current, Impedance, Admittance, Inductance, Capacitance, Factor, and Nyquist plots are all available. In addition, Custom plots can be used to present the results of a wide variety of different mathematical operations on buffered data.



2.13 Tracer

The Tracer instrument analyzes the characteristics of discrete semiconductor devices like diodes, NPN and PNP transistors, and both P-Type and N-Type FETs.

The dedicated IV Analyzer on the Analog Discovery Studio Max includes built-in reference resistors for accurate measurements as well as the option to operate externally for more custom designs.

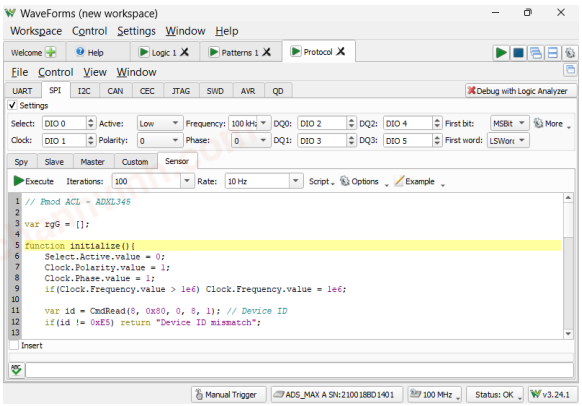


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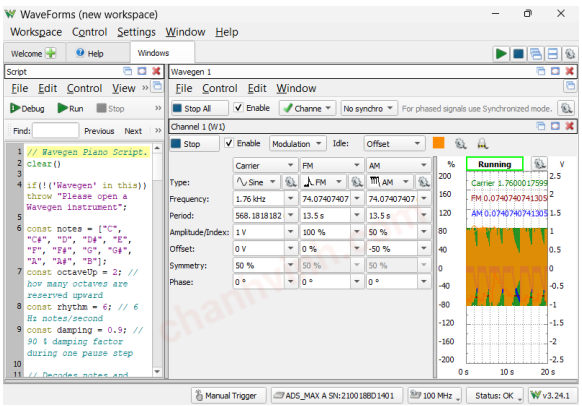
2.14 Protocol Analyzer

The Protocol Analyzer instrument generates and analyzes common communications protocols. UART, SPI, I2C, CAN, and various other kinds of transactions can be received, transmitted, and/or spied upon (depending on the protocol) by the Analog Discovery Studio Max using any of the digital input/output channels. Custom scripts can be written within the Protocol Analyzer instrument to generate sequences of SPI or I2C transactions.



2.15 WaveForms Script Editor

Each of WaveForms' instruments can be controlled through scripts within the WaveForms application itself. WaveForms' "Script" instrument allows the user to write and run JavaScript code that can control the rest of the application through an extensive API. This allows the user to configure and run many instruments at the same time, in an easily repeatable way.

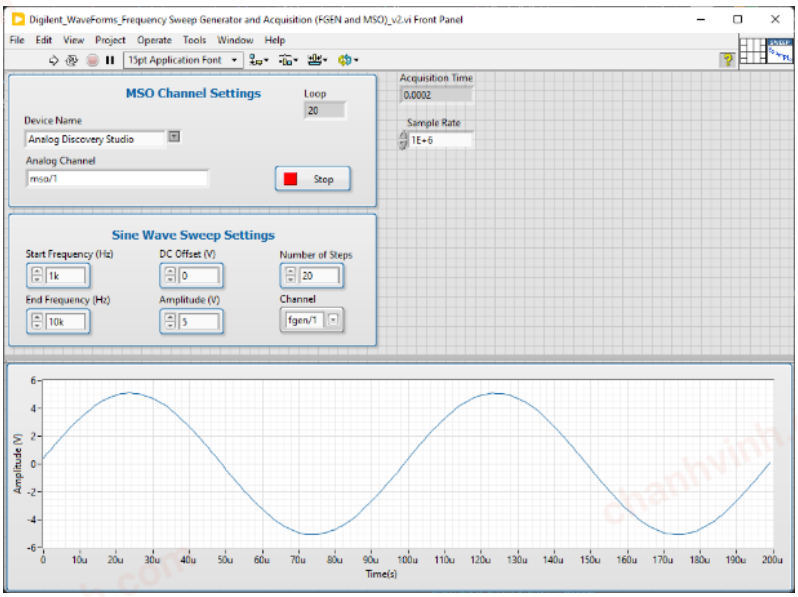


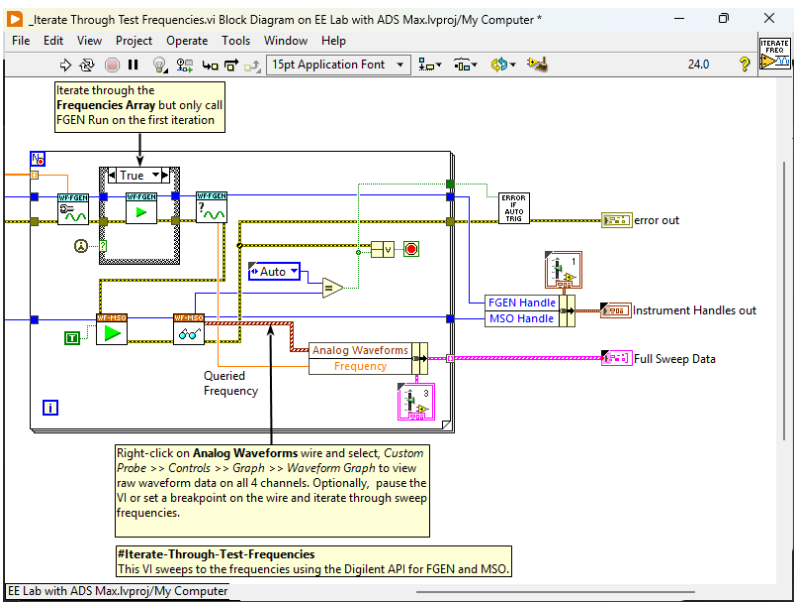
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3 Extended Software Support

Digilent has created the LabVIEW WaveForms Toolkit – a powerful add-on to the LabVIEW software combining the data acquisition capabilities of the Analog Discovery Studio Max with LabVIEW's extensive analysis functionality in an intuitive way. This leverages the strengths of both systems to create a curated experience for users wanting to merge the best of both worlds and enable engineering education to reach unprecedented heights. Further customization and control of the Analog Discovery Studio Max can be done through Digilent's WaveForms SDK, letting users create their own applications in C/C++, Python, C#, and Visual Basic.





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4 Analog Discovery Studio Max Specifications

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

All connections to attached Canvas add-ons must be made with the power off.

4.1 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	Four
Input Type	Single-ended
Connector Type	BNC
Input Range	±2 V with respect to ground (4 V peak-to-peak) ±25 V with respect to ground (50 V peak-to-peak)
Resolution	14 bits (16-bits with averaging), 13-bit noise[1]
Accuracy	2% of input ± 1% of full scale
Bandwidth	50 MHz DC @ -3 dB[2], 12 Hz AC coupling cut-off @ -3 dB
Input Impedance	1 MΩ || 15 pF
Input Coupling	DC, AC[3]
Vertical Sensitivity (range)	200 µV/div to 5 V/div (10 divisions)[4]
Acquisition Modes	average, decimate, min/max, record
Overvoltage Protection	±50 V_{DC} or ±30 V_{RMS}

DC Offset Range

Range	Full Scale	Offset	Offset Accuracy
Low range (≤0.2 V/div)	2 V peak-to-peak	±1 V	±25 mV
High range (>0.2 V/div)	50 V peak-to-peak	±25 V	±625 mV

[1] A separate small buffer to collect maximum and minimum samples when the sample rate is slower than the system frequency and is represented within WaveForms as noise.

[2] When using a connector with the appropriate frequency response.

[3] Selectable per channel within WaveForms.

[4] Divisions in this context are the ten horizontal strips in the Analog Input graph windows within WaveForms. Vertical sensitivity specifies the height of one strip in the plot.

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Horizontal System

Maximum Sample Rate	100 MS/s per channel
Maximum Oversampling Rate	400 MS/s per channel
Buffer Size	32,768 samples per channel
Noise Buffer	2,048 samples

The above horizontal system specifications apply to Repeated/Shift/Screen modes. Record mode allows streaming acquisition data into host computer RAM at up to ~1 MS/s total, or to a file on the host computer disk at up to ~800 kS/s total. Achievable sample rates and recording lengths depend on host computer specifications.

Digital Channels

Supports the Logic Analyzer, Pattern Generator, Static I/O, Protocol Analyzer, Oscilloscope (mixed signal view), and Script Editor instruments.

Vertical System

Number of Channels	16[1]
Connector	100 mil 2×10 MTE Header
Function Control	Individually programmable as Digital I/O, Logic Analyzer, Pattern Generator, or Protocol
Input Voltage	0 V to 3.3 V (5 V tolerant)
Input Type	5 V compatible LVTTL
Input Logic Level	Input Low Voltage, V_{IL}, Min 0 V, Max 0.8 V Input High Voltage, V_{IH}, Min 2 V, Max 5.25 V
Output Type	3.3 V LVTTL
Output Logic Level	Output Low Voltage, V_{OL}, Min 0 V, Max 0.4 V Output High Voltage, V_{OH}, Min 2.4 V, Max 3.465 V
Drive Strength	4 mA
Hardware Pull Resistors	1 MΩ pull-down resistors
Logic Analyzer Interpreters	SPI, I2C, UART, CAN, I2S, 1-Wire, PS/2, HDMI CEC, Manchester codes, JTAG, GPIB, SWD, custom[2]
Pattern Generator	Constant, clock, pulse, random, number, Binary counter, Gray counter, Johnson counter, Decimal counter, walking 0/1, ROM Logic, custom[2]
Custom Patterns File	Import and export custom data as *.csv, *.txt or *.tdms file
Channel-to-Channel Skew	2 ns, typical
Overvoltage Protection	Short-circuit to ground, ±20 V

[1] Up to 8 additional Digital I/O channel available through the PCI connector, depending on the Canvas installed.

[2] More options may be available in the latest version of the WaveForms software.

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Horizontal System

Maximum Sampling Rate	100 MS/s per channel
Logic Analyzer Buffer Memory	32,768 samples per channel
Pattern Generator Buffer Memory	16,384 samples per channel

The above horizontal system specifications apply to Repeated/Shift/Screen modes. Record mode allows streaming acquisition data into host computer RAM at up to ~1 MS/s total, or to a file on the host computer disk at up to ~800 kS/s total. Achievable sample rates and recording lengths depend on host computer specifications.

4.2 Arbitrary Waveform Generator (Wavegen)

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

Vertical System

Number of Channels	Two
Output Type	Single-ended
Connector Type	BNC
Standard Functions	Sine, square, triangle, ramp up, ramp down, DC voltage, noise, trapezium, others
Advanced Waveforms	Sweep, modulation (AM/FM), math, play mode, custom
Output Voltage Range	±10 V[1]
Resolution	14 bits (carrier), 15-bit (AM/FM)
Absolute Resolution	0.3 mV/LSB (|Vout| ≤ 2.5 V) 1.25 mV (|Vout| > 2.5 V)
Accuracy	± 0.5% (|Vout| ≤ 2.5 V) ± 0.5% (|Vout| > 2.5 V)
Output Impedance	50 Ω
Bandwidth	15 MHz @ -3 dB[2,3]
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
DC Current Drive	30 mA maximum
Slew Rate	188 V/µs (10 V step)
Overvoltage Protection	Short-circuit to ground, ±10 V

DC Offset Range

Range	Full Scale	Offset[1]	Offset Accuracy
Low range	2.5 V peak-to-peak	±10 V	±10 mV ± 0.5%
High range	10 V peak-to-peak	±10 V	±50 mV ± 0.5%

[1] The combination of signal amplitude and DC offset cannot exceed the output range specifications.

[2] When using a connector with the appropriate frequency response.

[3] Different pre-made waveform functions have different bandwidth results depending on the amplitude and frequency used.

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Horizontal System

Maximum Sample Rate	100 MS/s per channel
Carrier Buffer Size	16,384 samples per channel
AM/FM Buffer Size	4,096 samples per channel

4.3 Pattern Generator

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

4.4 Trigger System

Trigger Features

Trigger Sources	Oscilloscope analog channels, Arbitrary waveform generator start, Digital I/O lines, External trigger, 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	10 ns
Digital/Logic Analyzer Trigger Resolution	10 ns

External Trigger (Trigger) Characteristics

See the Digital Channels Specifications for the electrical characteristics of the External Trigger.

4.5 IV Analyzer

2 Wire Impedance Analyzer

Current range	±30 mA
Voltage sweep range	±10 V
Excitation frequency	1 Hz to 15 MHz

2/3 Wire Current-Voltage Analyzer

Supported devices	Diodes, NPN and PNP bipolar transistors
Base current range	±1 mA
Maximum collector current	±30 mA
Maximum collector voltage	±10 V

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Capacitance Measurement Range

The Effective Frequency and Effective Test Resistances were used for measurement with the single-tone test method.

Range	Effective Frequency	Effective Test Resistance
50 pF to 500 pF	10 kHz	100 kΩ
500 pF to 5 nF	1 kHz	10 kΩ
5 nF to 50 nF	1 kHz	10 kΩ
50 nF to 500 nF	1 kHz	1 kΩ
500 nF to 5 µF	1 kHz	1 kΩ
5 µF to 50 µF	1 kHz	100 Ω
50 µF to 500 µF	100 Hz	100 Ω

Inductance Measurement Range

The Effective Frequency and Effective Test Resistances were used for measurement with the single-tone test method.

Range	Effective Frequency	Effective Test Resistance
10 µH to 100 µH	100 kHz	100 Ω
100 µH to 1 mH	10 kHz	100 Ω
1 mH to 10 mH	10 kHz	1 kΩ
10 mH to 100 mH	1 kHz	1 kΩ

Inductance Measurement Accuracy	1% of range

4.6 Digital Multimeter

Functionality

Functions	DC Voltage, AC Voltage, DC current, AC current, resistance, diode, continuity
Resolution	4½ digits

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Input Protection

Isolation Level	Function isolation
Input Impedance	10 MΩ
Input Coupling	DC/AC
Voltage Input Protection	±60 V
Current Input Protection	3.5 A fuse, 5MF 3.5-R
Connectivity	Banana jacks

Measurements

Voltage Measurement

DC Ranges	50 mV DC, 500 mV DC, 5 V DC, 50 V DC
AC Ranges	50 mV RMS, 500 mV RMS, 5 V RMS, 30 V RMS
Input Frequency Range (AC voltage)	40 Hz to 8 kHz
DC voltage measurement accuracy (50 mV DC)	0.2% of range
DC voltage measurement accuracy (500 mV DC, 5 V DC, 50 V DC)	0.1% of range
AC voltage measurement accuracy at 50 Hz and 60 Hz (50 mV RMS)	0.2% of range
AC voltage measurement accuracy at 50 Hz and 60 Hz (500 mV RMS, 5 V RMS, 30 V RMS)	0.1% of range

Current Measurement

DC ranges	2 A DC
AC ranges	2 A RMS
Shunt resistance	20 mΩ
Input frequency range (AC current)	40 Hz to 8 kHz
DC current measurement accuracy	0.1% of range
AC current measurement accuracy at 50 Hz and 60 Hz	0.1% of range

Resistance Measurement

Ranges	50 Ω, 500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 50 MΩ
Resistance measurement accuracy (500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ)	0.1% of range
Resistance measurement accuracy (50 Ω, 50 MΩ)	1% of range

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4.7 Power Supplies

Variable Power Supplies

Number of Channels	Two	
Voltage Range	1 V to 15 V	-1 V to -15 V
Current Output[1]	+500 mA maximum	-500 mA maximum
DC Voltage Accuracy	±50 mV - $\|I_{out}\| \times 0.25$ mV/mA	±50 mV + $\|I_{out}\| \times 0.25$ mV/mA
Ripple and Noise	20 mV_{pk-pk}	55 mV_{pk-pk} + $\|V_{out}\| \times 10$ mV_{pk-pk}/V
Voltage Readback Accuracy	±15 mV	±15 mV
Current Readback Accuracy	±5 mA	±5 mA
Connector Type	Straight Plug	

Fixed Power Supplies

Number of Channels	Four			
Output Voltage (no load)[2]	15 V ± 5%	-15 V ± 5%	5 V ± 5%	3.3 V ± 5%
Rated Maximum Current Output[1, 3]	500 mA	500 mA	2 A	310 mA
Overload Maximum Current Output[4,5]	1.54 A (max)	0.69 A (max)	6.3 A (max)	1.54 A (max)
Ripple and Noise (20 MHz bandwidth)	150 mV peak-to-peak maximum	150 mV peak-to-peak maximum	50 mV peak-to-peak maximum	33 mV peak-to-peak maximum
Protection[6]	Short-circuit to ground			
Connector Type	Accessible on supported Canvas boards through the PCIe connector			

Solderless Breadboards

The Analog Discovery Studio Max includes a Canvas board that provides a removable prototyping surface with integrated solderless breadboards, LEDs, switches and direct access to the fixed power supplies. The integrated breadboards impose additional constraints due to contact resistance and thermal characteristics.

[1] Aggregate power limits apply. The Analog Discovery Studio Max can provide up to 40 W for simultaneous use on the USB host ports, fixed user power supplies, and the variable power supplies.

[2] Power up sequencing of the voltage rails is first the 5 V rail, followed by the 3.3 V rail, followed concurrently by both the +15 V and -15 V rails.

[3] The specified output currents represent maximum recommended continuous operating current for each rail. The output voltages will remain in tolerance while complying with their ripple and noise specification.

[4] The overload maximum values have been derived from thermal and regulation constraints under nominal operating conditions. Under overload conditions, the supplies may source current up to the maximum value, resulting in voltage overshoot/undershoot, increased noise, excessive heating, or permanent damage to the connected load.

[5] Maximum hiccup thresholds are not guaranteed and may trigger at a lower total current value on a per individual hardware basis.

[6] Protection circuitry is designed to respond to short-to-ground conditions only. The fixed power supplies include a built-in hiccup-type current limiting mechanism to help prevent some sustained high energy flow.

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Breadboard Operating Limits

Recommended Limits	±15 V and 2 A per contact
Aggregate Rail Current (distributed between contacts)	2 A
Short-Duration Maximum per Contact	Up to 3 A (with caution)
Rated Temperature	90° C

Thermal Considerations

The breadboard substrate and contact system are not designed for sustained high current, high voltage, nor high-power dissipation in immediate proximity. Localized excessive heating due to overcurrent, overvoltage and power dissipation in electrical or electronic components can cause:

- Increased contact resistance.
- Mechanical deformation.
- Intermittent or permanent connection failure.

Usage Guidelines

- Distribute loads across multiple tie points.
- Avoid continuous currents above 1 A through a single contact.
- Use power supplies that possess higher current capability with caution. A power rail working within its specifications can cause damage if the load overheats in proximity to the breadboard.
- The variable user supplies provide active current limiting down to 10 mA. These supplies can be used where tight current limiting is required.
- Use short, low resistance wiring.
- Minimize current path length across the breadboard.
- For loads exceeding 1–2 A or several watts, use external wiring or dedicated connectors.
- Place loads at a suitable distance from the breadboard to ensure any dissipated heat does not cause damage to the breadboard.

CAUTION: The output current ratings of the fixed power supplies are not internally enforced limits. Users are responsible for ensuring external loads do not exceed rated operating conditions. Exceeding these levels will cause overload and may result in localized heating, contact degradation, reduced reliability, and damage including overheating or melting of the breadboard, as internal protection does not prevent overcurrent or thermal stress. Use care when sizing and mounting loads to ensure current draw and heat dissipation remain within safe limits.

4.8 Device Configurations

The Analog Discovery Studio Max has one configuration which can be applied, primarily affecting the analog input, analog output, and digital I/O buffer sizes available to the user.

Configuration	Scope Buffer Size	Wavegen Buffer Size	Logic Buffer Size	Patterns Buffer Size
1 (Default)	32 kS 16-bit buffer per channel, 2k 13-bit noise buffer for each channel	16 kS 14-bit carrier buffer per channel, 4 kS 15-bit AM and FM buffers 4 kS variable Power Supply buffers	32 kS per channel	16 kS per channel

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 16 kS is rounded from 16 kiS, which is 16,384 samples.

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4.9 Additional Features

Spectrum Analyzer

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

Network Analyzer

Frequency Range	20 µHz to 10 MHz[1], up to 10,001 steps
Display Modes	Magnitude, Phase, Custom
Y Axis	Linear or Logarithmic
X Axis	Linear or Logarithmic
Plots	Bode, Time, FFT, Nichols, Nyquist

Protocol Analyzer

Shares digital input/output channels with Mixed Signal Oscilloscope: See the Digital Channels Specifications for the physical characteristics.

Protocol Interpreters	UART, SPI, I2C, CAN, CEC, JTAG, SWD, AVR, QD
Protocol Generators	UART, SPI, I2C, CAN, CEC, SWD, AVR

Impedance Analyzer

Frequency Range	20 µHz to 10 MHz[1], up to 10,001 steps
Display Modes	Magnitude, Phase
Y Axis	Linear or Logarithmic
X Axis	Linear or Logarithmic
Plots	Impedance, Phase, Voltage, Admittance, Capacitance, Custom[2]

[1] Higher frequencies up to 25 MHz can be selected within WaveForms but results may be limited by the analog input and output bandwidth of the hardware.

[2] Additional calculations not listed here are available within the WaveForms software.

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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, ceiling
Operands	All input channels, reference waveforms, time, constants, Pi
Custom Channels	Butterworth, Chebyshev, Lock-In Amplifier

4.10 Connectivity

USB Hub Interfaces

Device Connector	USB 2.0 Hi-Speed Type C[1] labeled “DEVICE”
Host Connector	USB 2.0 Standard-A, 900 mA[2] for additional hub connections
Device to Canvas	USB data pins and VBUS pins connected to PCI connector pins for Canvas use

4.11 Power Requirements

The Analog Discovery Studio Max comes with the required external power supply.

Auxiliary Power Supply Voltage	19 V
Auxiliary Power Supply Current	4.74 A recommended
Power Consumption	76 W Maximum, 20 W Typical

4.12 Physical Characteristics

Dimensions	26.68 cm × 39.09 cm × 5.51 cm (L × W × H) (10.50 in × 15.39 in × 2.17 in)
Weight	2.86 kg (6.30 lbs)[3]

4.13 Environmental

Ambient Operating Temperature	10 °C to 35 °C (50 °F to 95 °F)
Storage Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Operating Humidity	10% to 90% RH non-condensing
Storage Humidity	10% to 90% RH non-condensing
Pollution Degree	2
Maximum Altitude	5000 m

[1] USB Type C to USB Standard A cable included.

[2] Aggregate power limits apply. The Analog Discovery Studio MAX can provide up to 40 W for simultaneous use on the USB host ports, fixed user power supplies, and the variable power supplies.

[3] With the Analog Discovery Studio Canvas Max that is included with the Analog Discovery Studio Max, the total weight is 3.49 kg (7.69 lbs).

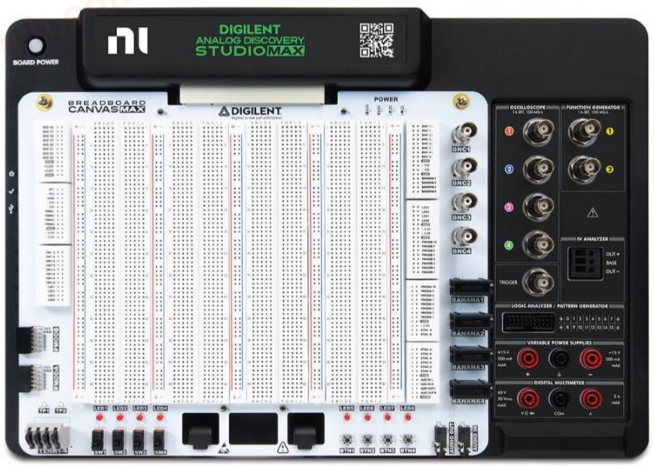
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4.14 Certifications and Statements

- CE Certification
- KC EMC Certification
- Safety, Environmental, and Regulatory Information
- Letter of Volatility

5 Ordering Information and Purchasing Options





Associated Digilent Part Numbers:

- 410-435 – Analog Discovery Studio Max (base purchase kit)
  - One Analog Discovery Studio Max
  - One Analog Discovery Studio Canvas Max
  - One 19 V 4.74 A power supply
  - One USB A to C cable
  - One Screwdriver and
  - One set of Analog Discovery Studio Max Flywire Cables
- 240-153 – Probes and Cables add-on available for the ADS Max
  - Pair of DMM leads, One red and one black lead.
  - Four 150 MHz BNC Oscilloscope Probes
  - One 6-pin header and gender changer (5-pack)
  - One Breadboard Wire kit
  - One Banana Plug to Alligator Clips, red and black
  - Pair of BNC Male to Alligator Clip, 650mm
  - Pair of BNC male to BNC male coax cable, 12 inch
  - Pair of Banana to Banana cables, one red and one black
- Users will be able to select the power cable appropriate for their region
  - 310-021-1 – US Power Cable for the ADS Max
  - 310-021-2 – EU Power Cable for the ADS Max
  - 310-021-3 – UK Power Cable for the ADS Max

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6 Recommended Accessories

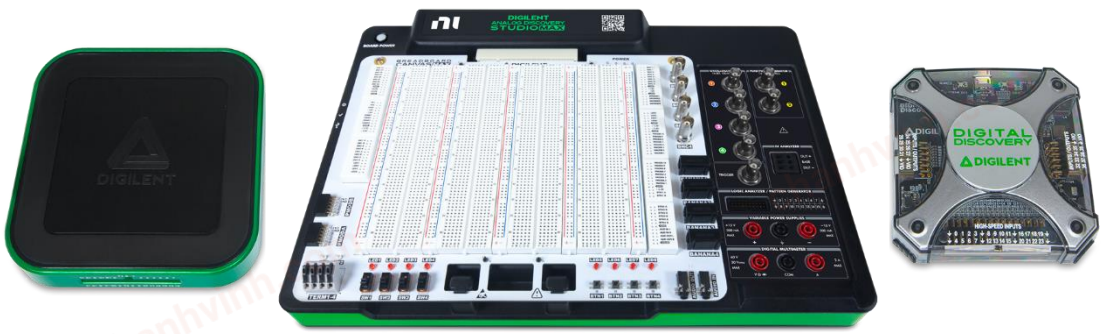
Additional Canvas Add-ons

A variety of additional Canvas boards created by our Partners that provide curated engineering education learning, design, and system integration experiences are available for the Analog Discovery Studio Max. The complete list of Canvas boards is available to review on Digilent's Reference site at https://digilent.com/reference/test-and-measurement/analog-discovery-studio-max/canvases/start.

7 Additional Resources

Reference material for the Analog Discovery Studio Max including a getting started guide, reference manual, specifications, and tutorials on each of the instruments within WaveForms can be found on the Analog Discovery Studio Max's Resource Center on Digilent's Reference site.

8 The Essential Instruments Family



Digilent's Essential Instruments family is the premier offering for engineers looking for a low barrier to entry while broadening their expertise with Test and Measurement equipment. These devices are cost-optimized for students and engineers alike, provide maximum value for minimal cost. From the Digital Discovery, a dedicated workhorse for debugging digital interfaces, to the Analog Discovery Studio Max, an all-in-one electronics laboratory, to the legendary Analog Discovery 3, in conjunction with Digilent's freely available WaveForms software, each device provides a solid foundation for any engineer who needs to test or debug their projects.

Analog Discovery 3

The Analog Discovery 3 is a multi-function test and measurement device, offering a digital oscilloscope, logic analyzer, waveform generator, pattern generator, and much more – all in a device that fits in the palm of your hand. In combination with differential inputs, programmable power supplies, and the flexible WaveForms software (supported by Windows, Mac, and Linux), the Analog Discovery 3 can be used in the lab, in the field, or even at home - you're no longer tied down to a traditional benchtop and stacks of expensive test instruments.

Digital Discovery

The Digital Discovery is a combination USB logic analyzer and pattern generator, featuring 24 high-speed digital inputs and 16 digital I/O channels. With a high-speed adapter, the device can sample up to 800 MS/s on up to 8 input channels. Sampling up to 100 MS/s is supported on all channels. DDR memory offers deep input buffers, with 64 MS of input buffer per high-speed input channel.

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9 Analog Discovery Pro Line



Digilent's Analog Discovery Pro line is for users who are ready to go pro. With expanded feature sets not offered in Digilent's Test and Measurement Essentials line including deep memory, higher bandwidth, networking capability, and USB 3.2, an Analog Discovery Pro device has already stepped up to the challenging task ahead of you.

Devices in the Analog Discovery Pro family provide the utility of professional benchtop equipment with the flexibility of a portable instrument. The series includes mixed signal oscilloscope and programable power supply instruments that give engineers the ability to tap into the efficiency of the WaveForms software while offering a wider selection of specifications in products created with the professional in mind. Members of the Analog Discovery Pro family include:

Analog Discovery Pro 2000-Series

- Mixed signal oscilloscope
- BNC connectors and an aluminum case
- Multiple analog input channels
  - ADP2230: Two analog inputs – 50+ MHz bandwidth
  - ADP2440: Four analog inputs – 100+ MHz bandwidth
  - ADP2450: Four analog inputs – 200+ MHz bandwidth
- One analog output – 15 MHz bandwidth
- 16 Digital I/O
- High sample rates
  - ADP2230: up to 125 MS/s
  - ADP2440: 600 MS/s for analog inputs
  - ADP2450: 1 GS/s for analog inputs
- Two programmable power supply outputs on the ADP2230
- Deep memory buffers for long acquisitions
  - ADP2230 –256 MB to share among channels
  - ADP2440/ADP2450 – 512 MB to share among channels
- USB 3.2 connectivity
- Dual Mode for synchronization of multiple devices

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Analog Discovery Pro 3000-Series

ADP3450/ADP3250:

- Mixed signal oscilloscope
- Four or two analog inputs, two analog outputs
- 0.5 GS/s sample rate (with oversampling), per channel
- 55+ MHz bandwidth
- 16 Digital I/O
- Ethernet connectivity
- Embedded Linux Mode

Analog Discovery Pro 5000-Series

ADP5470/ADP5490:

- Mixed signal oscilloscope
- Four analog inputs, one analog output
- 1.5 GS/s or 2 GS/s sample rate, per channel
- 350 MHz or 500 MHz bandwidth
- 34 Digital Inputs at 1 GS/s, 8 Digital I/O
- Dedicated Digital Multimeter and DC Power Supplies

Discovery USB-Programmable Power Supply (DPS3340)

- USB programmable power supply
- Three programmable output channels with optional waveform generator control
- 1 V to 5 V (up to 1 A), -1 V to -15 V (up to 500 mA), 1 V to 15 V (up to 500 mA)
- Integrated voltage and current readback of each channel

10 About Digilent

Digilent, part of the NI Product Family, has been at the forefront of innovation since 2000, crafting hardware and software solutions that empower engineers, researchers, educators, and scientists to design and test with unparalleled flexibility. Our customizable solutions cater to both seasoned professionals and emerging engineers, accelerating development while maintaining a low barrier to entry.

We're committed to making engineering accessible, offering competitive pricing, portable products, and comprehensive documentation. With a global presence spanning three continents, Digilent ensures speedy and cost-effective access to our products through an extensive distribution network. Specializing in USB-based test and measurement devices, flexible and intuitive software, low-cost data acquisition and data logging tools, and AMD-based FPGA development boards, our products' design philosophy champions your creativity. By providing world class documentation and support and keeping our hardware and software flexible and practical, we are continuing to provide the building blocks while you bring the brilliance.

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