Digilent's Analog Discovery (DAD)

Tutorial

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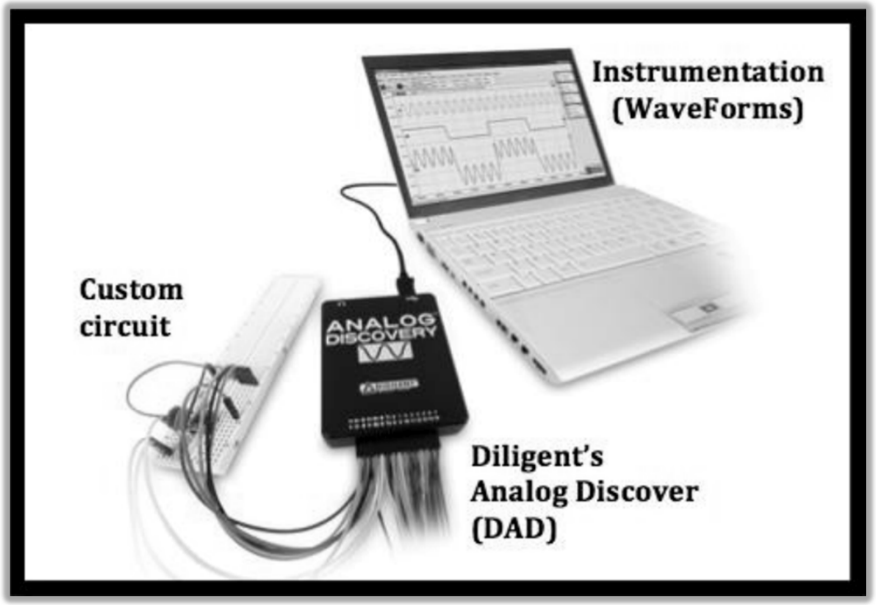
‘Who’ is DAD?

- An electrical engineering virtual workstation
- Lets you:
  - Measure
  - Visualize
  - Analyze
  - Record
  - Control



- Accompanied by WaveForms software for command, control, data handling, etc.

“DAD is small enough to fit in your pocket, but powerful enough to replace a stack of lab equipment!”

- Digilent Inc.

Features of DAD

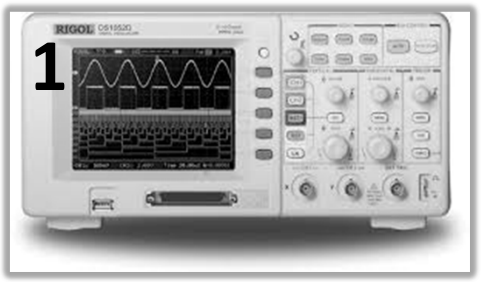
1 2-Channel Oscilloscope

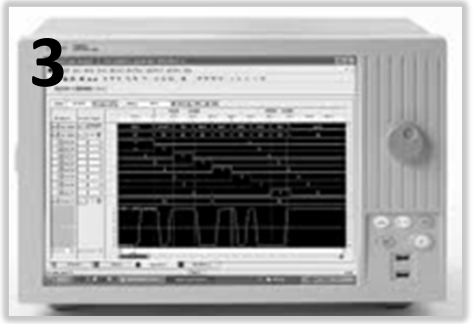
2 2-Channel Waveform Generator

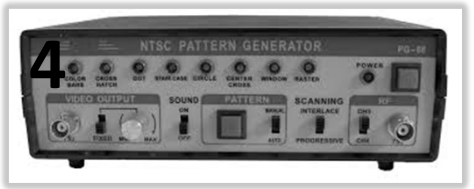
3 16-Channel Logic Analyzer

4 16-Channel Digital Pattern Generator

- ±5VDC Power Supplies
- Voltmeter
- Digital I/O
- Spectrum Analyzer
- Network Analyzer
- Supported by MATLAB *(student edition)*



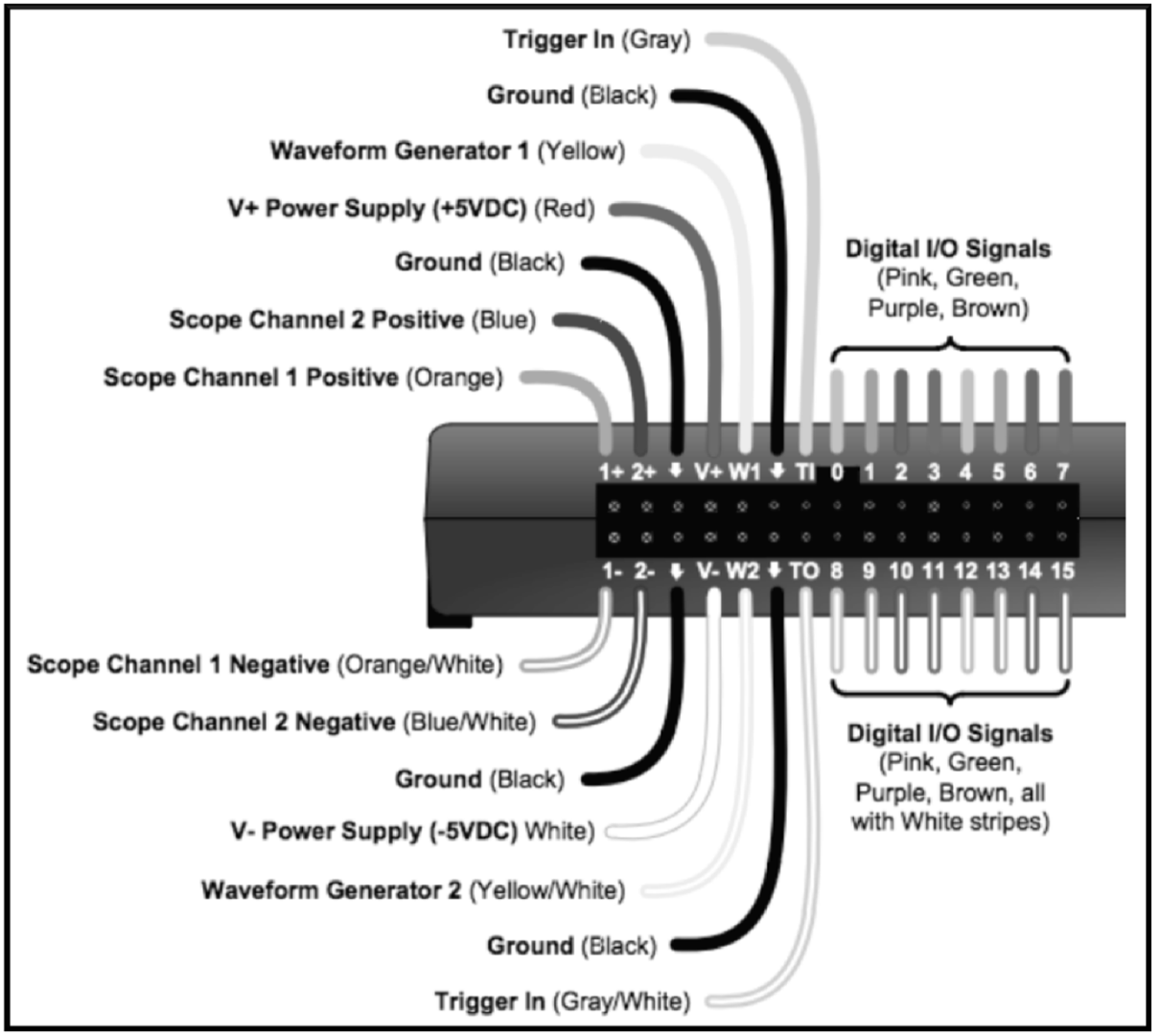




DAD Pin Configuration

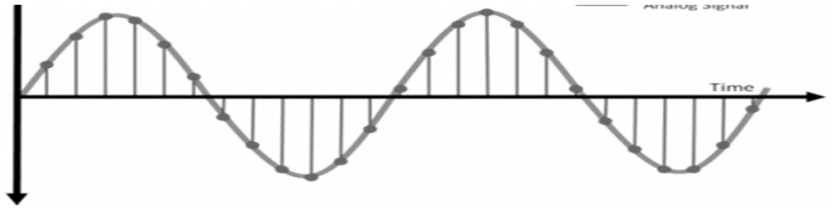
Main Features:

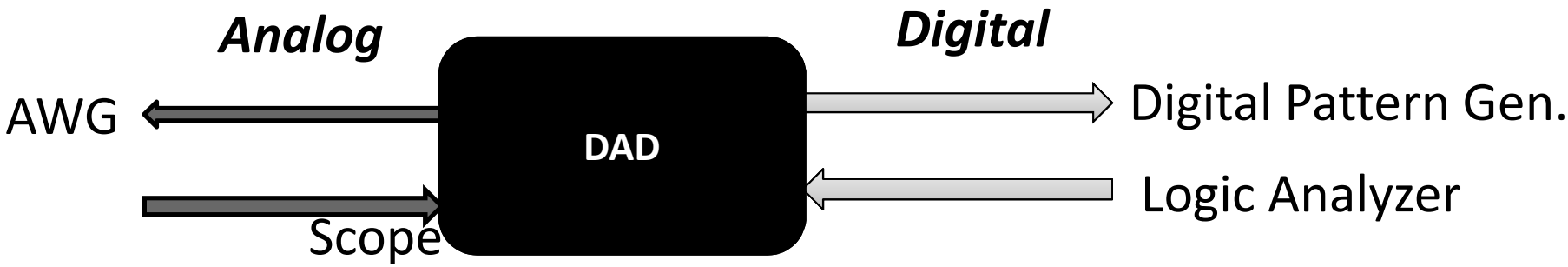
- 2-chan. Oscilloscope
- 2-chan. Waveform Gen.
- 16-chan. Logic Analyzer
- 16-chan. Digital Pattern Gen.
- ±5VDC Power Supplies
- Trigger



DAD Functions

- Analog
  - Arbitrary Waveform Generator (AWG)
  - Oscilloscope (Scope)
- Digital
  - Digital Pattern Generator
  - Logic Analyzer

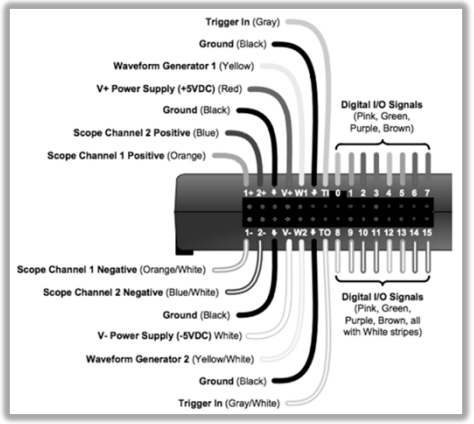




Arbitrary Waveform Generator (AWG)

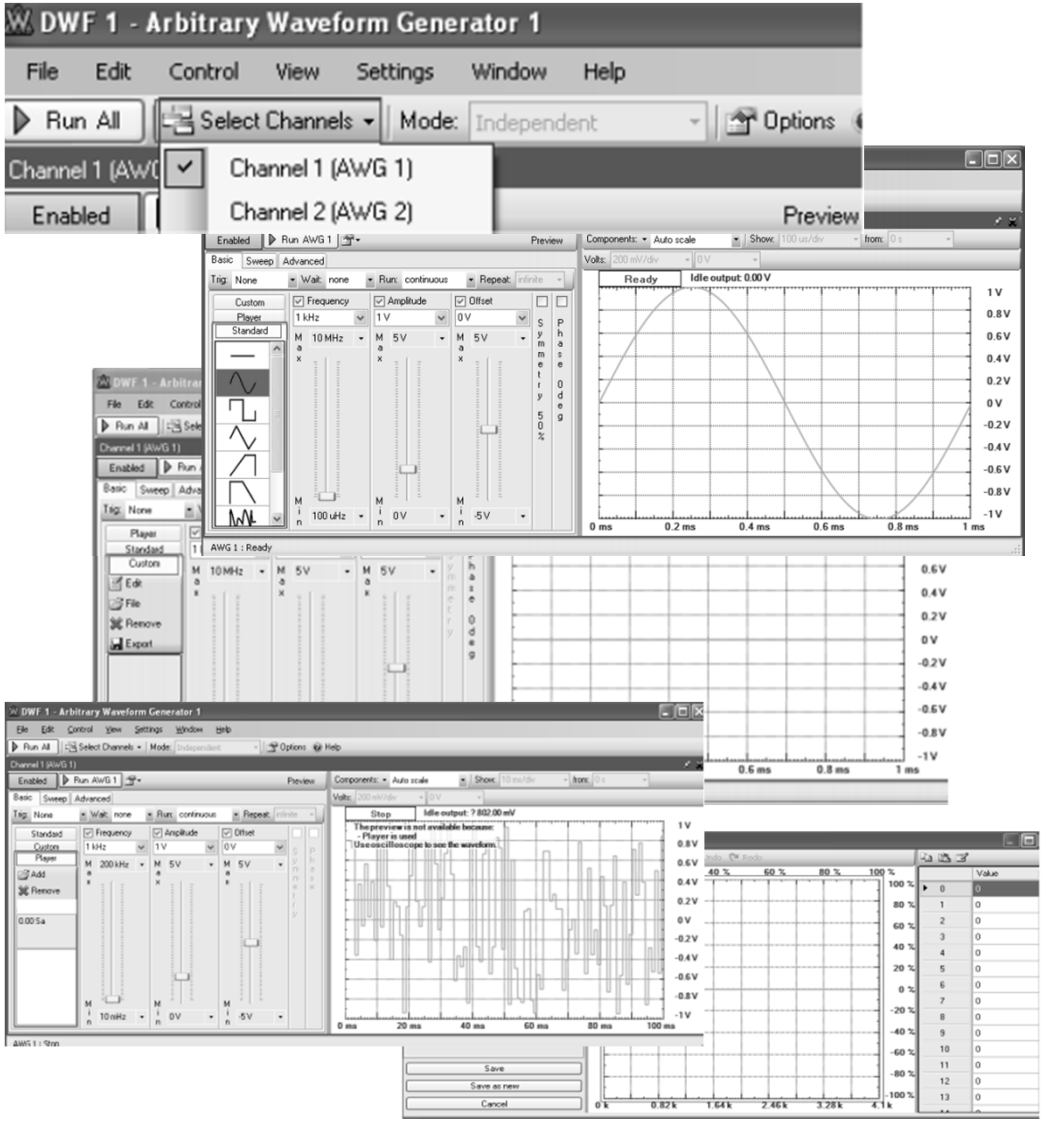
- 2 channels available: AWG1, AWG2
  - Maximum amplitude voltage +/- 5V
- Each channel independently generates standard waveforms: sine, triangular, sawtooth
- WaveForms software allows for easy customization of parameters of the waveform
- Channels also generate arbitrary waveforms based on user definitions

On the DAD, the two AWG channels are W1 and W2, with yellow and yellow/white wires, respectively



Demo

- Select a channel:
  - AWG1 or AWG2
- Create a waveform using:
  - Standard tab
  - Custom tab
  - Player tab
- Design a waveform using:
  - Editor window



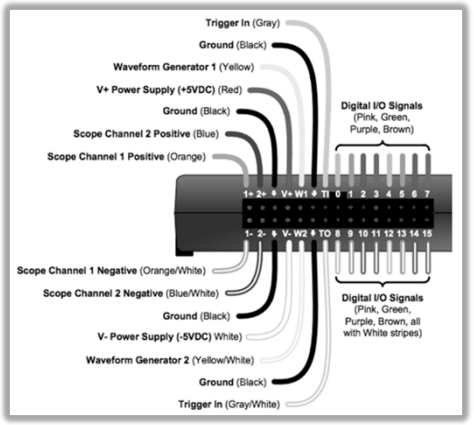
AWG Hints

- Note:
  - To correctly setup the connections, in addition to connecting W1 or W2 to your circuit, the ground terminal of your circuit must be connected to the ground wire (black color) of the DAD.
- Useful Feature:
  - While the voltage instrument can be used to apply only fixed voltage to a circuit, AWG is more flexible and can apply varying voltages to a circuit.
- Warning:
  - To avoid getting shocked, you should make sure that the Enable/Disable button is disabled when working on your circuit. This will cut off all voltage supply to the AWG.

Oscilloscope (Scope)

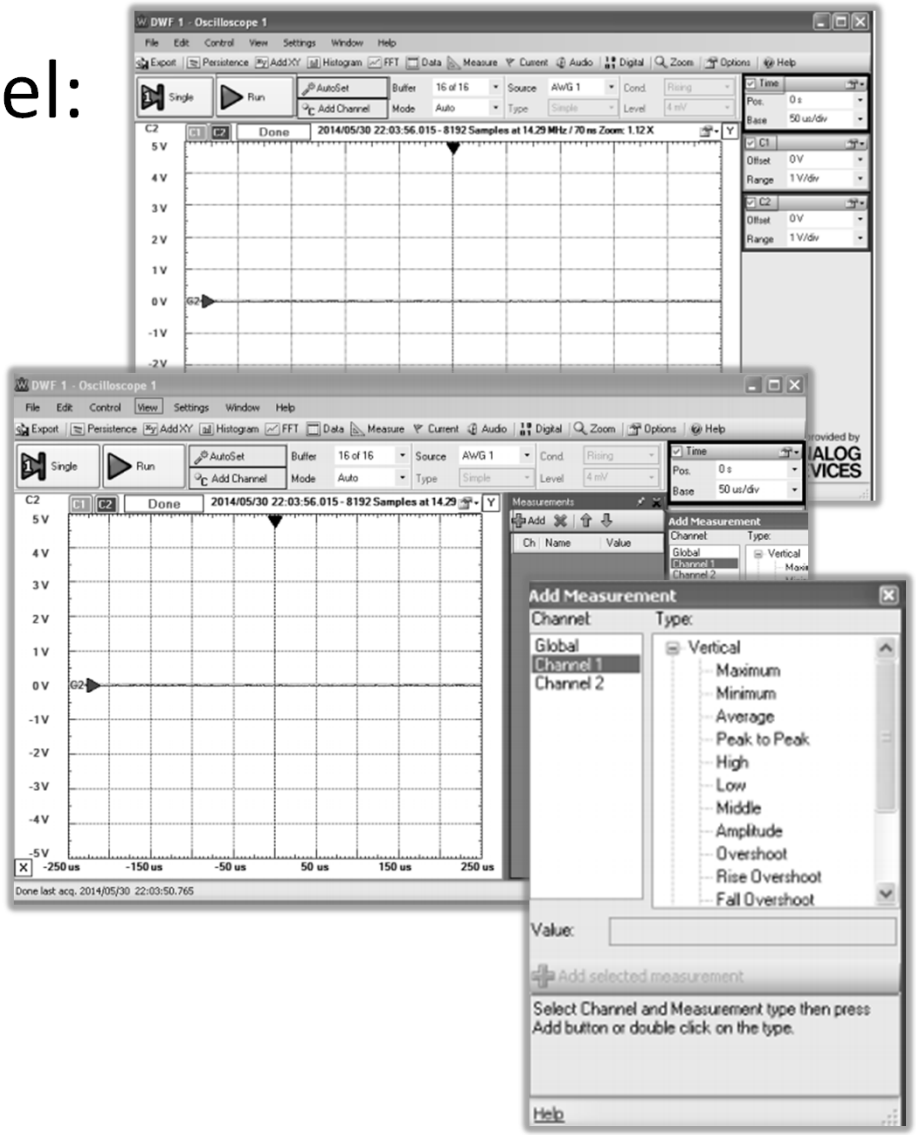
- 2 channels available: C1, C2
  - Analog inputs of up to +/- 25V
- Each channel independently supports various sampling mode
  - Average, decimate, minimum and maximum
- WaveForms software allows allows captured data to be exported to standard file formats (for example, .csv)
- More advanced features such as FFT, XY plots and Histograms

On the DAD, the Scope channels are the terminals 1+ and 1- for channel 1, and 2+ and 2- for channel two



Demo

- Enable/Disable a channel:
  - C1 or C2
- Visualize waveform
- Add measurement



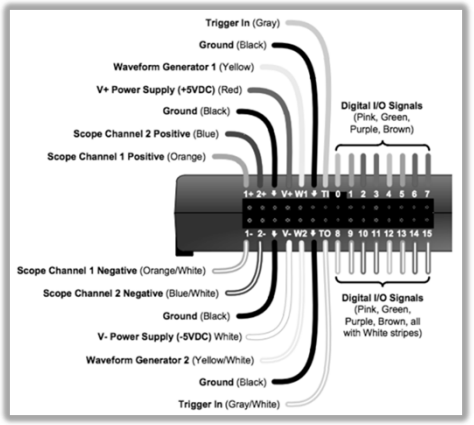
Scope Hints

- Note:
  - Note that for a given channel, the positive terminal of the scope must connect to the positive terminal of your circuit, and negative terminal of the same channel connected to the negative terminal of the circuit (often the ground signal).

Digital Pattern Generator

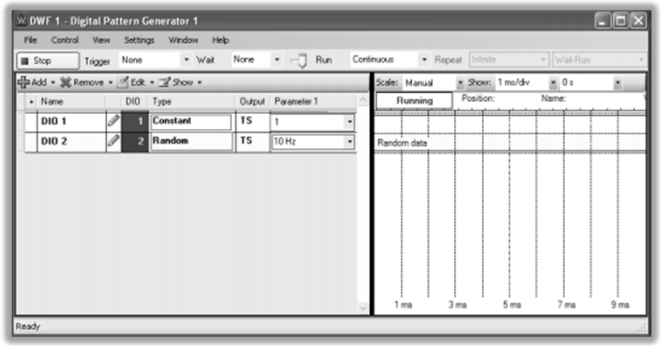
- 16 channels for digital logic: DIO-0 ~ DIO-15
  - Maximum 3.3V can be sourced from each signal line
- Generates various digital pattern for output on DIO's
  - Counters: binary, gray, Johnson
  - Clock signal
  - Custom defined
- WaveForms software allows for import and export of data using standard file formats
- In most cases, DIO's are used to interface with the bus, reset, clock and other GP I/O's of your circuit

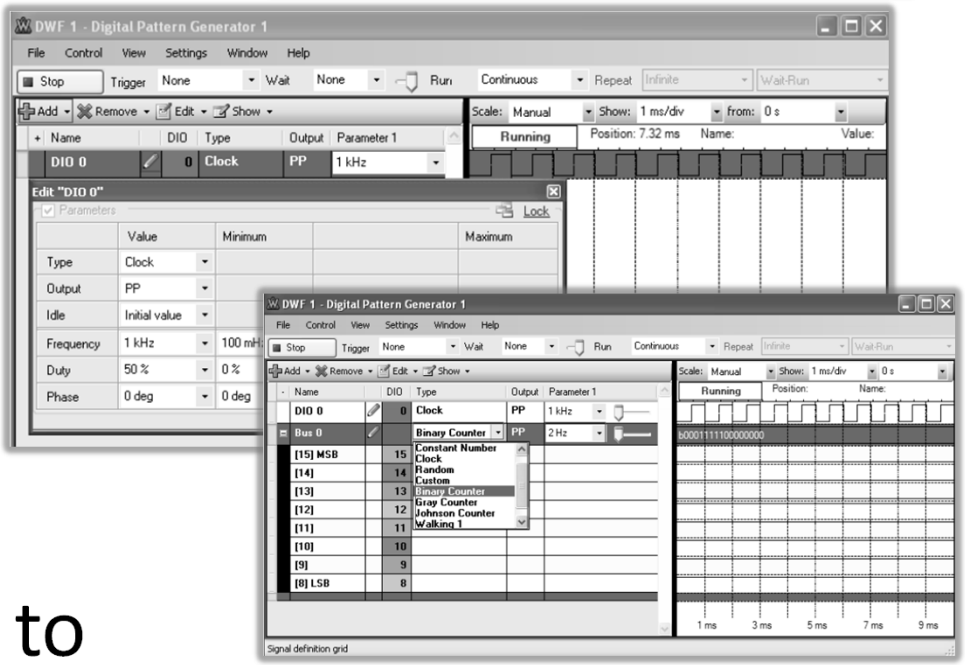
On the DAD, the Digital Pattern Generator channels are labeled 0 through 15

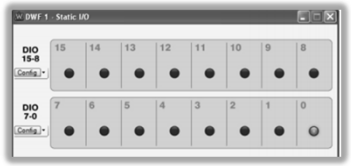


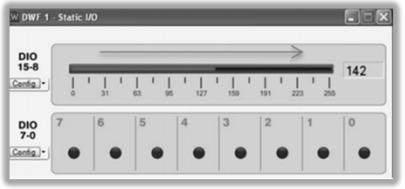
Demo

- Add a signal line
- Modify signal line parameters
- Generate the signal:
  - Clock
  - Single-bit constant
  - Random data
- Generate signal on bus
- Use Virtual Instrument to visualize signal









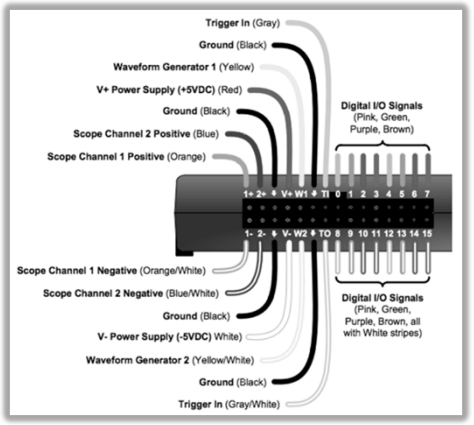
Scope Hints

- Useful Feature:
  - A third digital function unit called Static I/O is also within WaveForms for simulating bit I/Os, 7- segment slider and progress bar functionalities.

Logic Analyzer

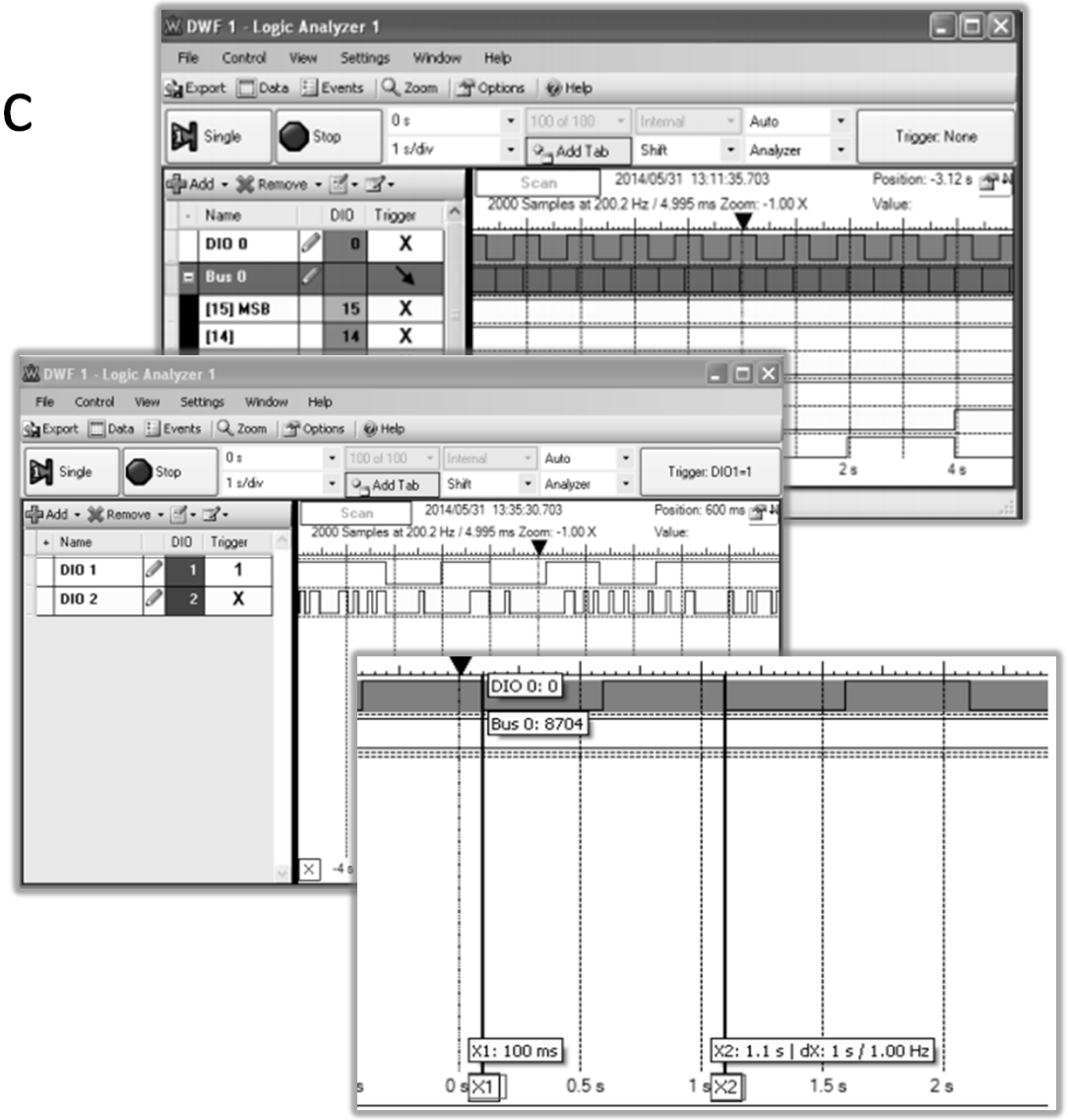
- 16 channels for digital logic: DIO-0 ~ DIO-15
  - LVCMOS input: provides support for low-voltage logic
- Analyzes signal logic states: single bit and bus signals
  - Provides measurement tools
- Can serve as an interpreter for commonly used communication protocols: SPI, I2C, UART, parallel bus

On the DAD, the Logic Analyzer channels are labeled 0 through 15



Demo

- Analyze an input logic
  - Clock signal
  - 8-bit wide bus signal
- Analyze other types of input signals:
  - Toggled
  - Random
- Perform simple measurement in Logic Analyzer



Conclusion

- DAD can be used to generate various kinds of analog and digital signals
- It is a very handy tool for debugging mixed signal circuits
- Virtual instruments enable visual simulation of digital patterns

More Stuff

- Product page
  - http://tinyurl.com/DAD-page
- Short videos
  - http://tinyurl.com/DAD-vids

Q&A