General Information about
Pico DSOs (Digital Storage Oscilloscopes)

Finding The Right Scope!

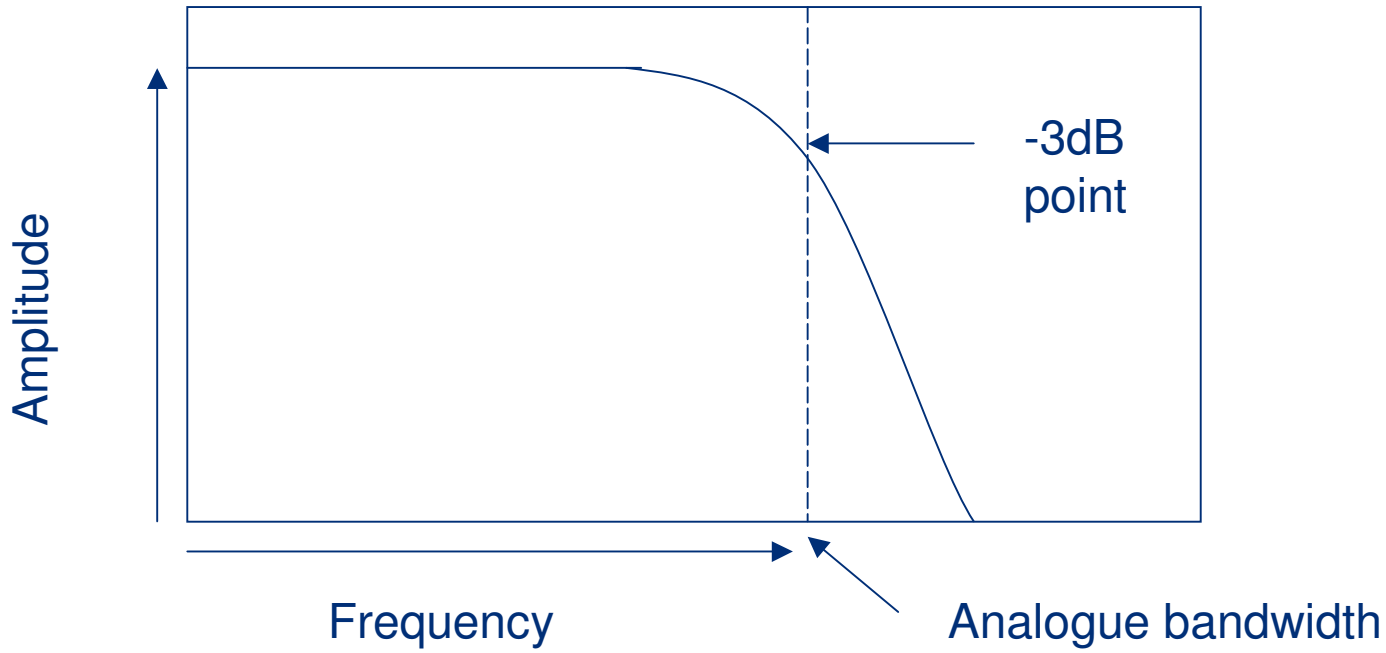
- What is the frequency of the signal you are trying to measure?
- How long do you want to look at the signal for?
- How many channels are you looking for?
- What is the amplitude of the signal you are trying to measure?
- How much detail do you want to get out of your amplitude?

What To Look For In DSO

- Four major points need to be considered for any DSO (Digital Storage Oscilloscope):
  - Analogue bandwidth
  - Sample rate
  - Memory (buffer length/ sample length)
  - Vertical resolution

Analogue Bandwidth

- The maximum frequency that can pass through the front end of your oscilloscope
- To be specific, most scope manufacturers define this as the frequency at which a sine wave will be attenuated to 71% of its true amplitude (-3dB point)



Analogue Bandwidth

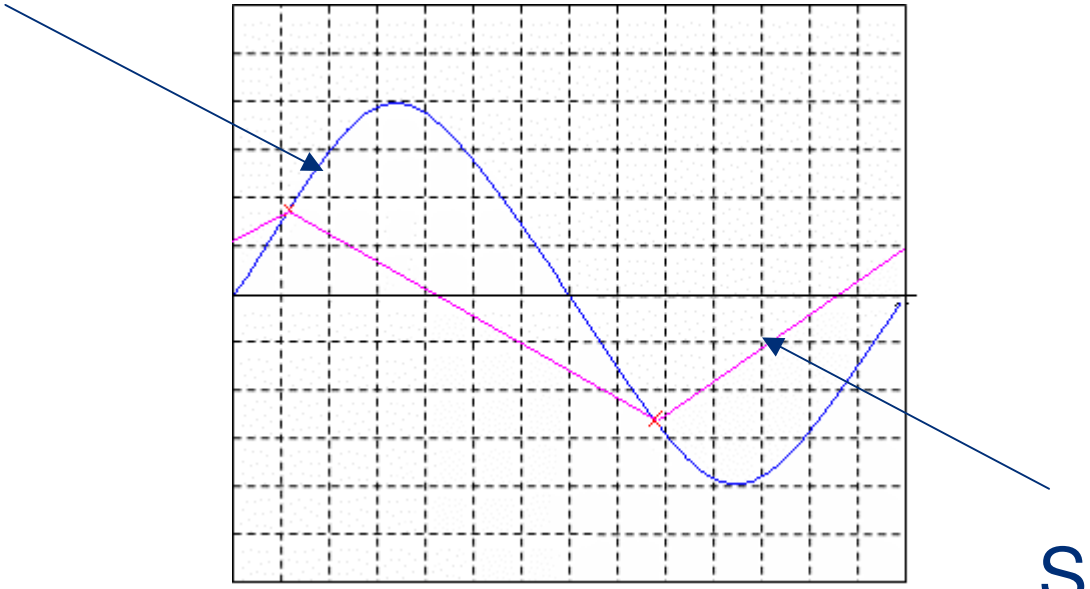
- Rules of thumb
  - Analogue bandwidth frequency has to be higher than maximum frequency of signal you are measuring
  - Note: when measuring square waves ensure the bandwidth of the scope is at least 3-5 times higher than the frequency of the square wave
    - Since a square wave is made up of higher frequency components (in fact a perfect square wave has infinite frequency components)

Sample Rate

- Once the analogue signal has gone through the front end it needs to be sampled
- It depends on how many points are used to define the shape of the waveform
- This is usually measured in MS/s and/or GS/s
- The more points (samples) we use, the better a representation of the original waveform we obtain

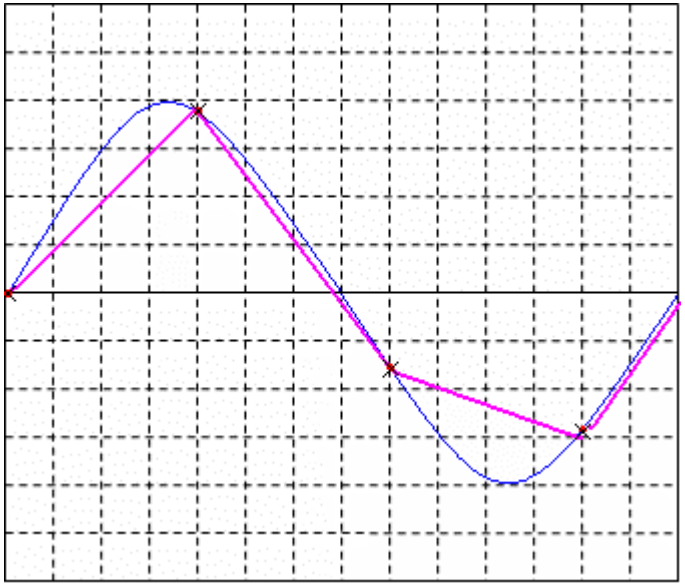
2 Samples

Analogue signal

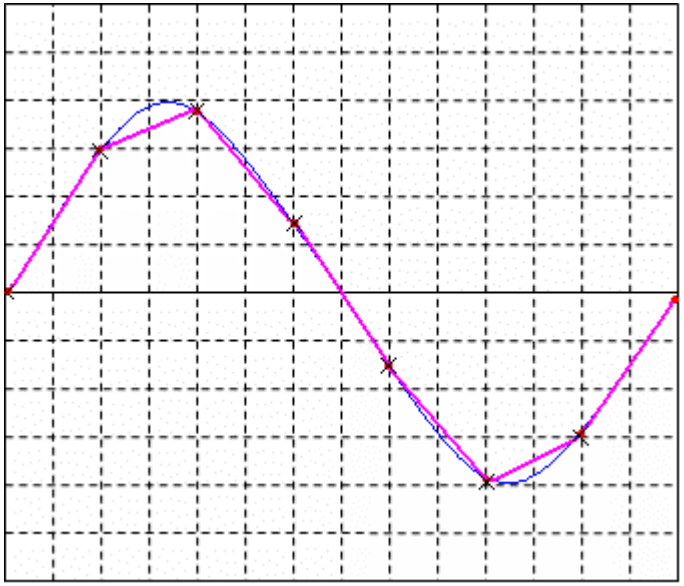


Sampled signal

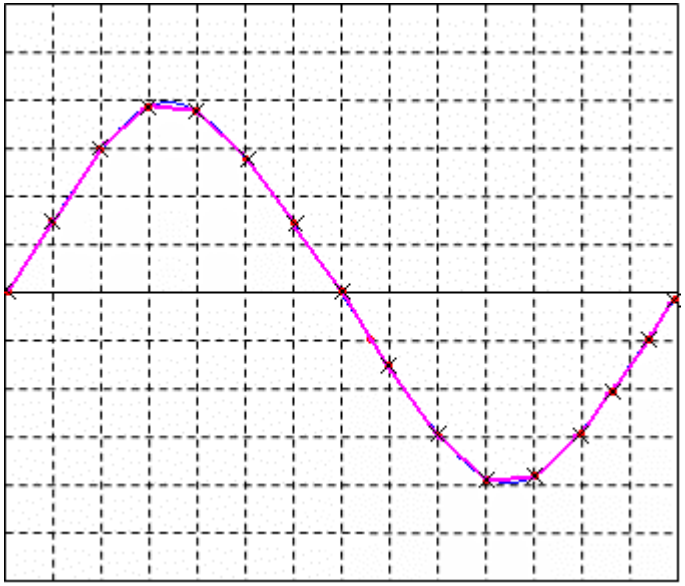
4 Samples



7 Samples



15 Samples



Interpolation In DSO

- Interpolation is a method of modifying the acquired waveform by generating predicted samples between the acquired points (samples)
- This is a software interpretation of the sampled data
- Two methods are generally used:
  - Linear Interpolation (as shown in previous slides) this works in essence by connecting the dots
  - Sin(x)/x interpolation: based on the assumption that Nyquist's criterion is met, a signal can be constructed identically. This method is generally used by most scope manufacturers for DSOs (this is a feature in PicoScope 6)

Sample Rate

- Rule of thumb
- Scope mode
  - We need to sample at least 2.5 times quicker than the analogue signal when using Sin(x)/x interpolation
    - Or with Linear interpolation you would need at least 5 to 10 times the sample rate
- Spectrum mode
  - Sampling has to be at least 2 times the rate of the measured signal

Memory Depth

- Memory depth / buffer memory is an important concept in DSOs
- DSOs can capture samples in a buffer memory for a given sample rate, the size of the buffer determines how long it can capture a signal before the memory is full
- i.e. the bigger the memory the longer you can sustain high sample rates

Memory Depth in Comparison

- PicoScope 6403
  - Sample rate 5GS/s
  - Bandwidth 350 MHz
  - Memory 1GS
    - 20ms/div at 5GS/s
    - 100,000 times longer than TDS3044B!

- Tektronix TDS3044B
  - Sample rate 5GS/s
  - Bandwidth 400MHz
  - Memory 10kS
    - 200ns/div at 5GS/s

Vertical Resolution

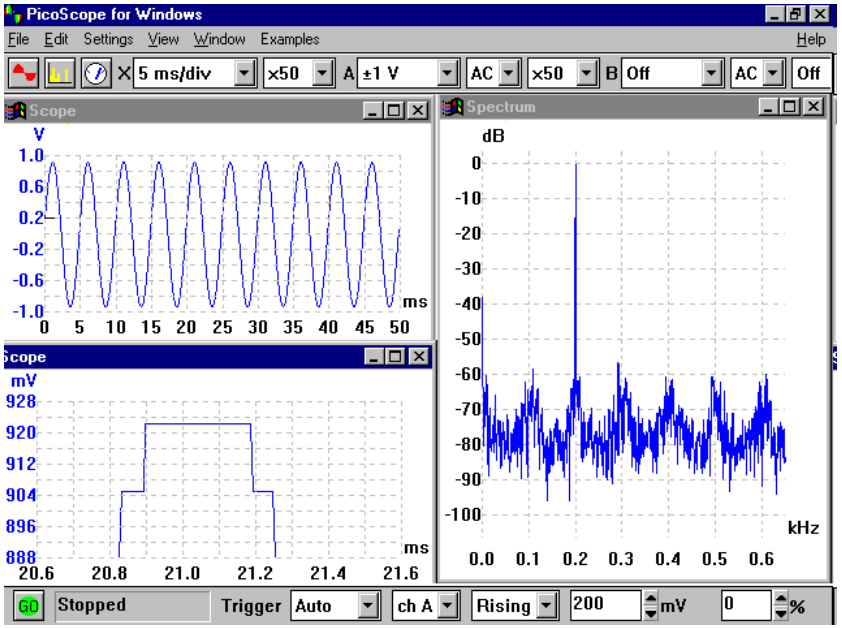
- Defines the minimum change in voltage you can represent
- It is measured in bits
- We provide scopes that are 8 bits and 12 bits
- 8 bits is equivalent to 256 increments across your full range
- 12 bits is equivalent to 4096 increments across your full range

Vertical Resolution

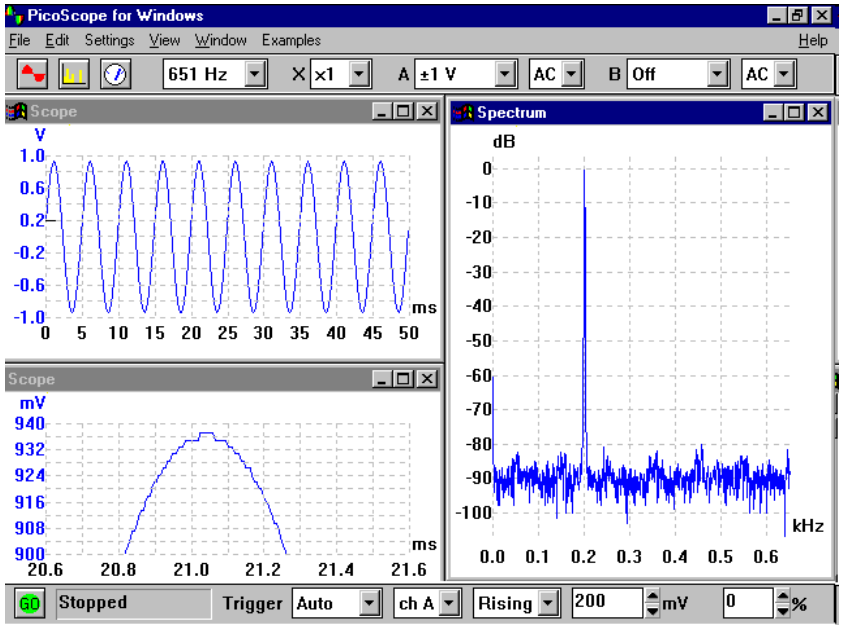
- Using Pico oscilloscopes we have up to 9 voltage ranges, from +/-50mV to +/-100V (product dependant)
- In each of those ranges you have the same number of bits
- So if for example we chose a +/-1V range using an 8 bit scope (256 steps) the smallest step would 7.8mV
- In a 12 bit scope (4096 steps) this would be 4.9µV
- i.e. more bits gives more detail available in the vertical axis

Vertical Resolution

8 bits



12 bits



- Frequency domain
  - High resolution increases the dynamic range
  - This can be useful in audio applications or any scenario where large and small voltages are important to assess in detail.

Summary Of What To Look For In A DSO

- Bandwidth
  - Max frequency that the scope can take in
- Sample rate
  - How well this waveform is represented
- Memory depth
  - How long can we look at this signal at a given sample rate
- Vertical resolution
  - How much detail can we get out of our voltage

PicoScope 6 Functions

- Oscilloscope
- Frequency spectrum view (FFT)
- Signal/Arbitrary Waveform Generator (AWG)
- Curve trace persistence
- High speed data logger (long time base)
- Serial decoding (CAN bus)
- XY- view

PicoScope6 Features

- 95% of screen dedicated to waveform display
- Familiar windows look and feel
- Instantly save as image
- Easily export data in a number of formats
- Automatic measurements with statistics
- Measurement rulers
- Advanced triggers
- Maths channels

Features (continued)

- Resolution enhancement
- Reference waveforms
- Probe wizard
- Zoom panning controls
- Waveform buffer (1000 screens)
- Over 1M spectrum bins
- Mask Testing (coming soon)
- Plus many more

Product Range

- Pico products encompass a wide span of specifications:
  - Analogue bandwidth
    - 5 MHz to 350MHz
  - Sample rate
    - 20MS/s to 5GS/s
  - Buffer memory
    - 8kS to 1GS
  - Vertical resolution
    - 8 bits to 12 bits
  - Channels
    - 1 to 4 channels

Summary Table

Scope	BW (MHz)	SR (MS/s)	Buffer Memory	Channel	Res (bits)	AWG	External Trigger	Adv' Triggers
2104	10	50	8k	1	8	N	N	N
2105	20	100	24k	1	8	N	N	N
2203	5	40	8k	2	8	Y	N	N
2204	10	100	8k	2	8	Y	N	N
2205	25	200	16k	2	8	Y	N	Y
3204	50	50	256kS	2	8	Y	Y	N
3205	100	100	512kS	2	8	Y	Y	N
3206	200	200	1MS	2	8	Y	Y	N
3425	5	20	512kS	4	12	N	N	Y
4224	20	80	32MS	2	12	N	N	Y
4424	20	80	32MS	4	12	N	N	Y
4226	50	125	32 MS	2	12	Y	Y	Y
4227	100	250	32 MS	2	12	Y	Y	Y
5203	250	1GS/s	32MS	2	8	Y	Y	Y
5204	250	1GS/s	128MS	2	8	Y	Y	Y
6402	350	5GS/s	32MS	4	8	Y	Y	Y
6403	350	5GS/s	1GS	4	8	Y	Y	Y

More Product Details…

Please feel free to visit our PSE online shop for further information about the Pico DSOs:

www.priggen.com

Thank You!

PSE- PRIGGEN SPECIAL ELECTRONIC

PC Hosted Instruments, DSOs, Data Loggers & Automotive Diagnostics

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