Lab – 1 Datasheet

CpE 4010: Sensors, Actuators and Integration

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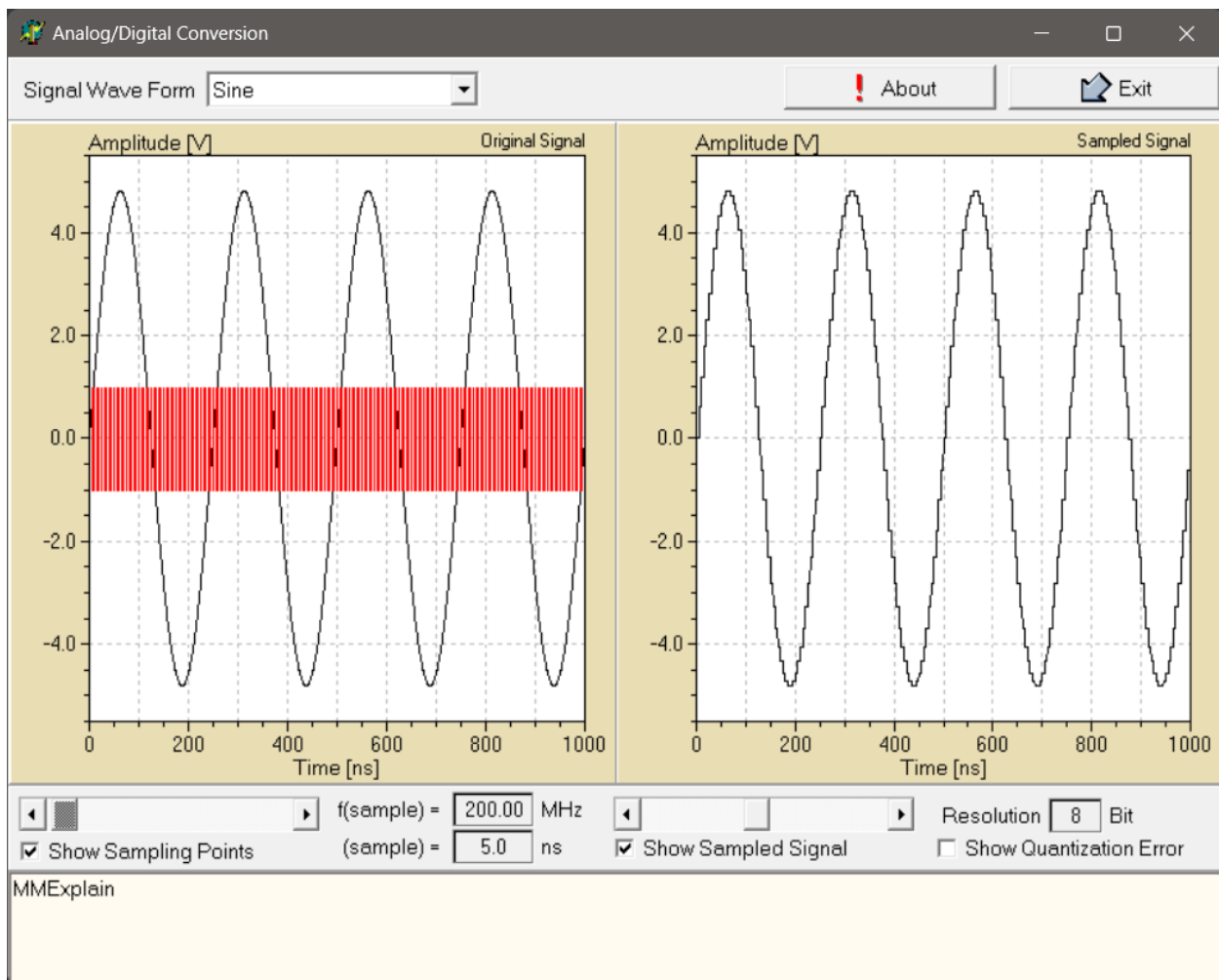**From procedure 3:**

Period of default sine wave_____200ns_____

From procedure 4:

Calculated Nyquist Rate_____200MHz_____

From procedure 6:

Insert your screenshot of Nyquist Rate waveform here:

From procedure 8:

Describe appearance of sampled signal with 37 MHz sampling rate here:

Far fewer samples are taken and it results in the right function looking extremely choppy.

37MHz represents the original signal far worse than the previous 200MHz sampling frequency. There is a lot more error that takes place between each sampling internal. It's not as smooth as the previous.
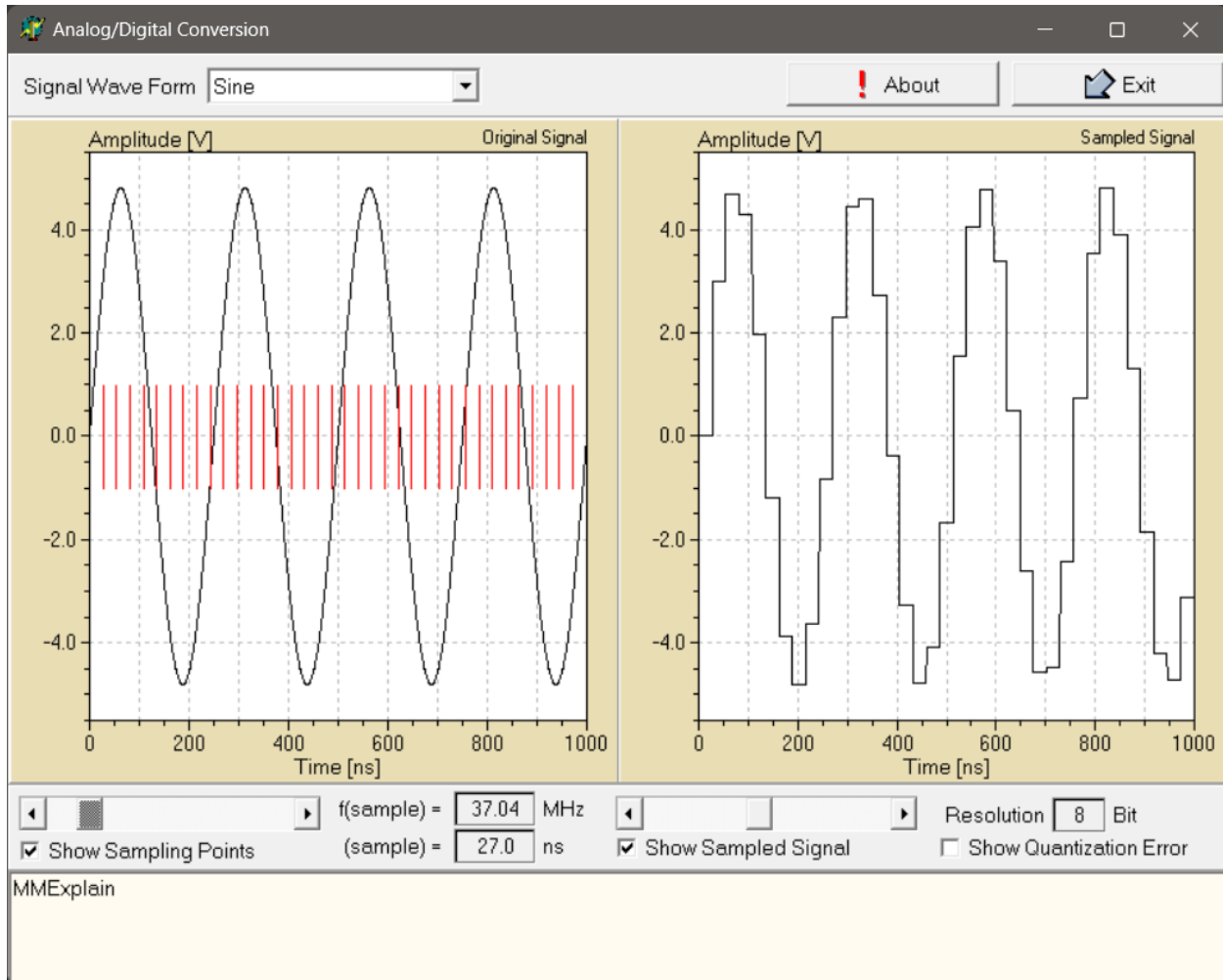
From procedure 9:

**Describe appearance of sampled signal with 1-bit resolution here:**

It's completely changes the look of the sampled signal to what looks like a step function either a high or a low, no in-between.
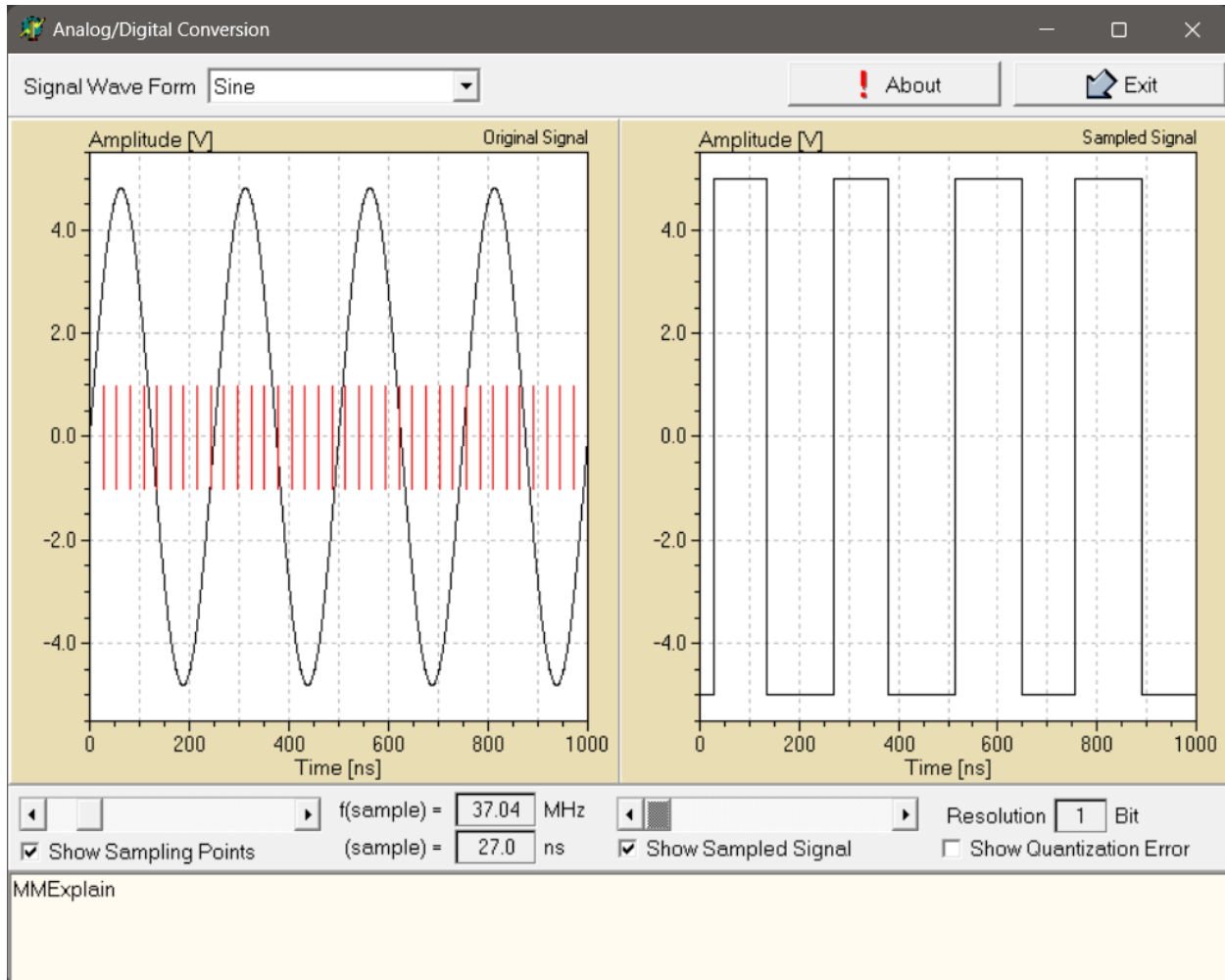
From procedure 11:

Sampling rate (frequency) to produce smooth sinusoid_____500MHz_____

The rate in step 4 was 200MHz, I've set the sampling frequency to 500MHz and that is 2.5 times greater than previously.
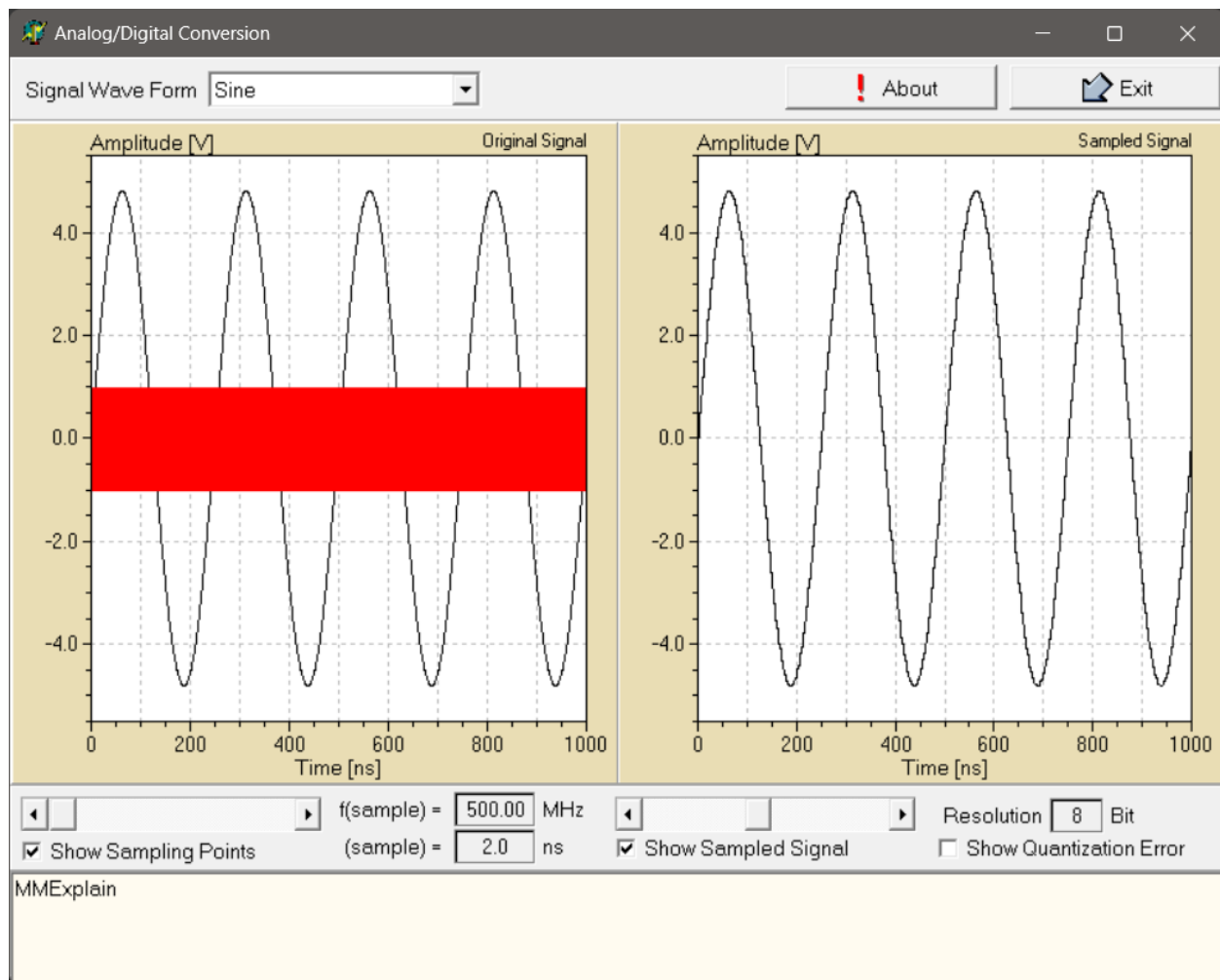
From procedure 12:

Describe quantization error here:

Quantization error is the error that occurs when the analog signal is converted to a digital signal but is limited to the number of levels it can ultimately read into. This means that since the digital signal is being measured a certain fixed intervals the analog signal get rounded to the nearest digital value.

The higher bits we get higher resolution, hence lower error.
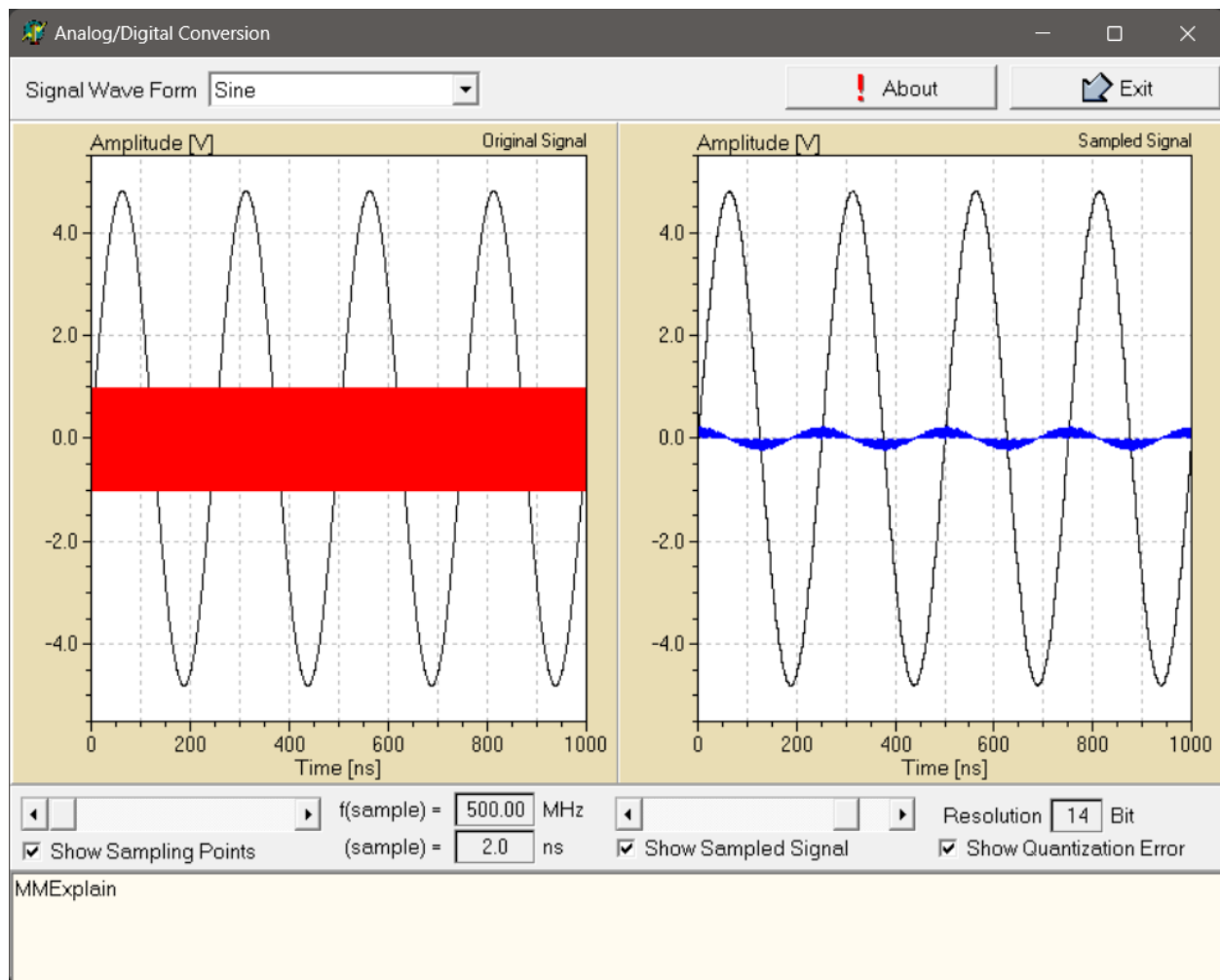
The lower bits, the lower resolution we have, this leads to higher quantization errors.
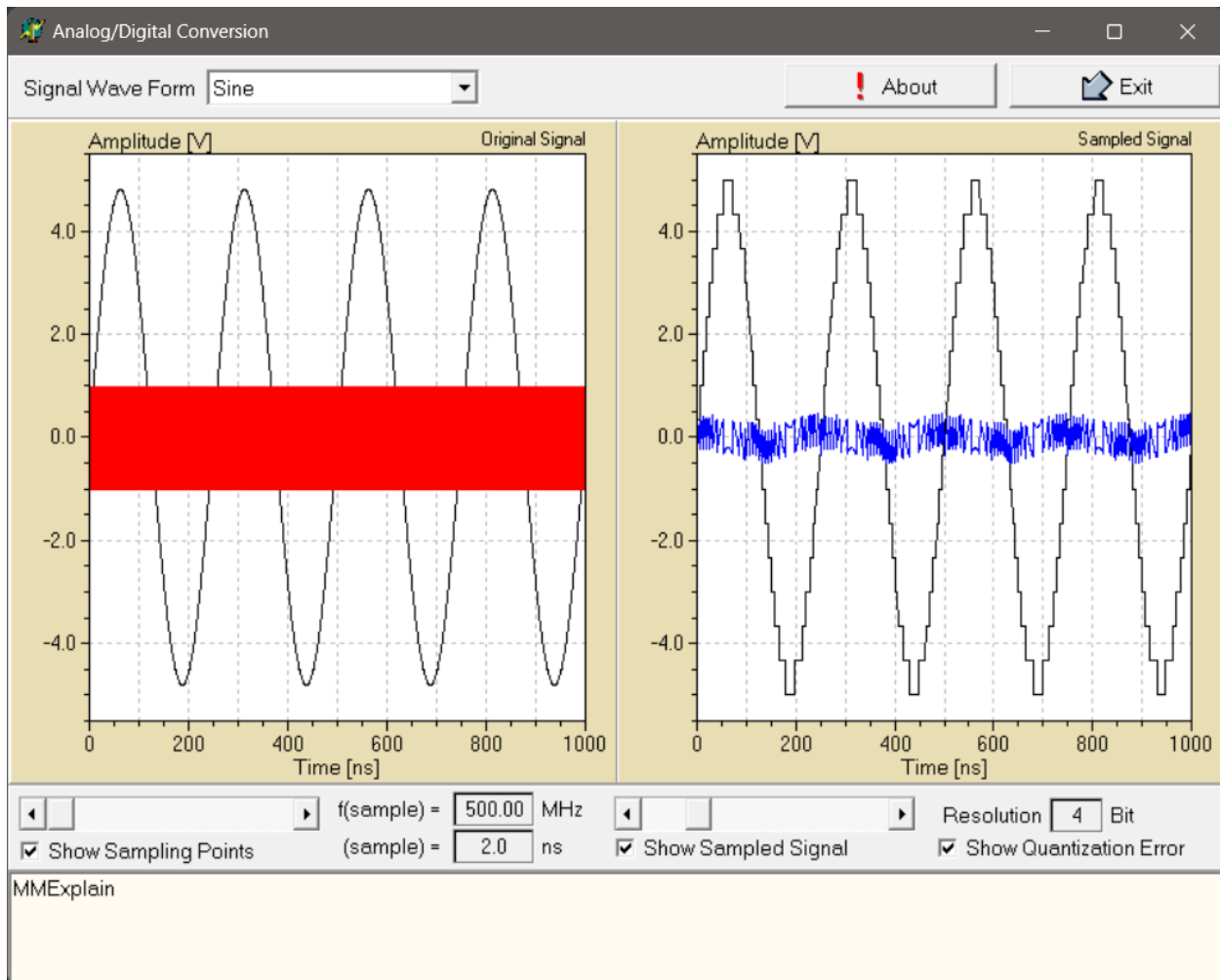
Conclusions:

The Nyquist Rate shows that sampling at least 2 times the signal frequency prevents errors in depicting the sampling signal.

Sampling frequency being reduced can represent poor signal representation.

Quantization determines the detail level in the sampled signal, and the associated error arises from rounding the signal amplitude to discrete values. A higher bit resolution allows for finer representation and lower quantization error, while lower bit resolution results in greater quantization error and a more distorted signal.